Grinding and Finishing

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The Magazine Devoted Exclusively to Abrasive Operations

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★ FEATURES

International Harvester Holds Automation Conference

Developing Standard Time Data for Grinding Operations—Part 2

Significance and Measurement of Surface Finish—Part 3

Special Belt Grinder Cuts Costs of Weld Grinding

ALSO IN THIS ISSUE

Safety
Letters to the Editor
Free Literature
What's New in Equipment and Materials

chcock publication

NOVEMBER, 1956

How to get a better finish and extend wheel life

Just be sure to use the grinding fluid that's right for the job—the metal and the type of grinding you're doing. Then you can count on finer finish, faster grinding, fewer rejects, fewer wheel dressings and longer wheel life. Those are the benefits that add up to increased production . . . lower unit costs. Let's be specific—

For surface and centerless grinding an emulsion of *Texaco Soluble Oil* is generally recommended. This has the high cooling ability necessary for this type of work; and will quickly settle out the grinding dirt so wheels won't load. *Texaco Soluble Oil* emulsions are remarkably stable and the oil is an effective rust preventive. Another advantage: operators everywhere remark on the cleanliness of their machines.

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There is a complete line of *Texaco Cutting, Grinding and Soluble Oils* to help you do all your machining better, faster and at lower cost. Let a Texaco Lubrication Engineer help you. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

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NOVEMBER, 1956—VOL. 2, NO. 7

B 621704

Grinding and Finishing

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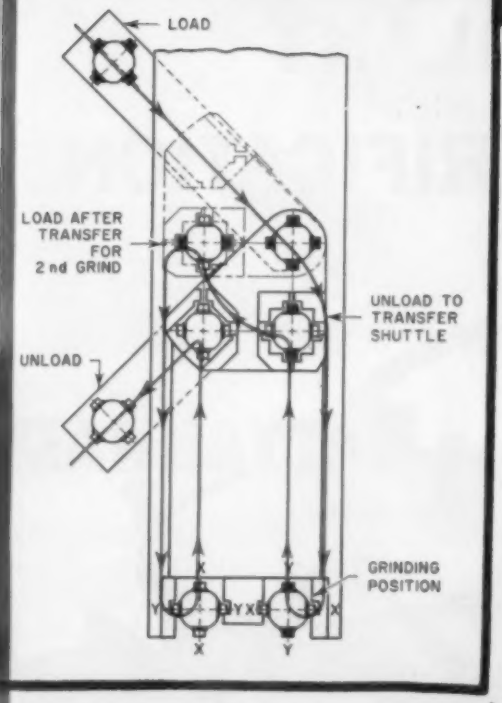
BPA

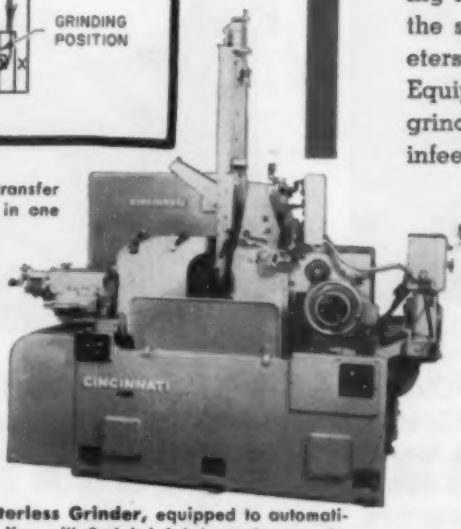
FILMATIC
CINCINNATI

Unique Transfer Idea Solved This Problem:

To Automatically Grind Four Diameters of Universal Joint Spiders In One Cycle



Schematic drawing of loading and transfer fixture. Parts are ground on axis X in one station, and axis Y in the other.



Two universal joint spiders are in process at the same time, grinding two pin diameters on each of two parts. Estimated production, 300 completed parts per hour.

Everyone familiar with universal joint spiders will agree that it's a neat trick to automatically grind the two pin diameters on each of two parts at the same time. Cincinnati automation specialists devised a way to do the job on a new CINCINNATI® FILMATIC No. 2 Centerless Grinder. A unique transfer mechanism, incorporated in the loading fixture developed by Cincinnati for the machine, was the key to this low-cost method of production. Principle of operation is diagramed at the left. ¶ There are four grinding and four regulating wheels. To advance from one grinding station and set of wheels to the next, the transfer mechanism, during the retraction segment of the grinding cycle, simply takes the part from the first station, swings it 90°, orienting it and depositing it on the loading fingers for the second operation. In this manner, four diameters and adjacent radii are ground each cycle. Equipment includes automatic profile truing for the grinding wheel and electro-hydraulic automatic infeed attachment. ¶ The manufacture of universal joint spiders may not be your line of work, but some type of precision cylindrical grinding is required in your shop, and Cincinnati grinding and automation specialists can help you do a better job at lower cost. You can be sure that these men will give you the benefit of the most advanced thinking in centerless grinding methods, backed up by 33 years' experience. May we hear from you?

CINCINNATI GRINDERS INCORPORATED
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CINCINNATI FILMATIC No. 2 Centerless Grinder, equipped to automatically grind universal joint spiders. You will find brief information on the standard No. 2 machine in Sweet's Machine Tool File. For complete data write for catalog No. G-644-1.

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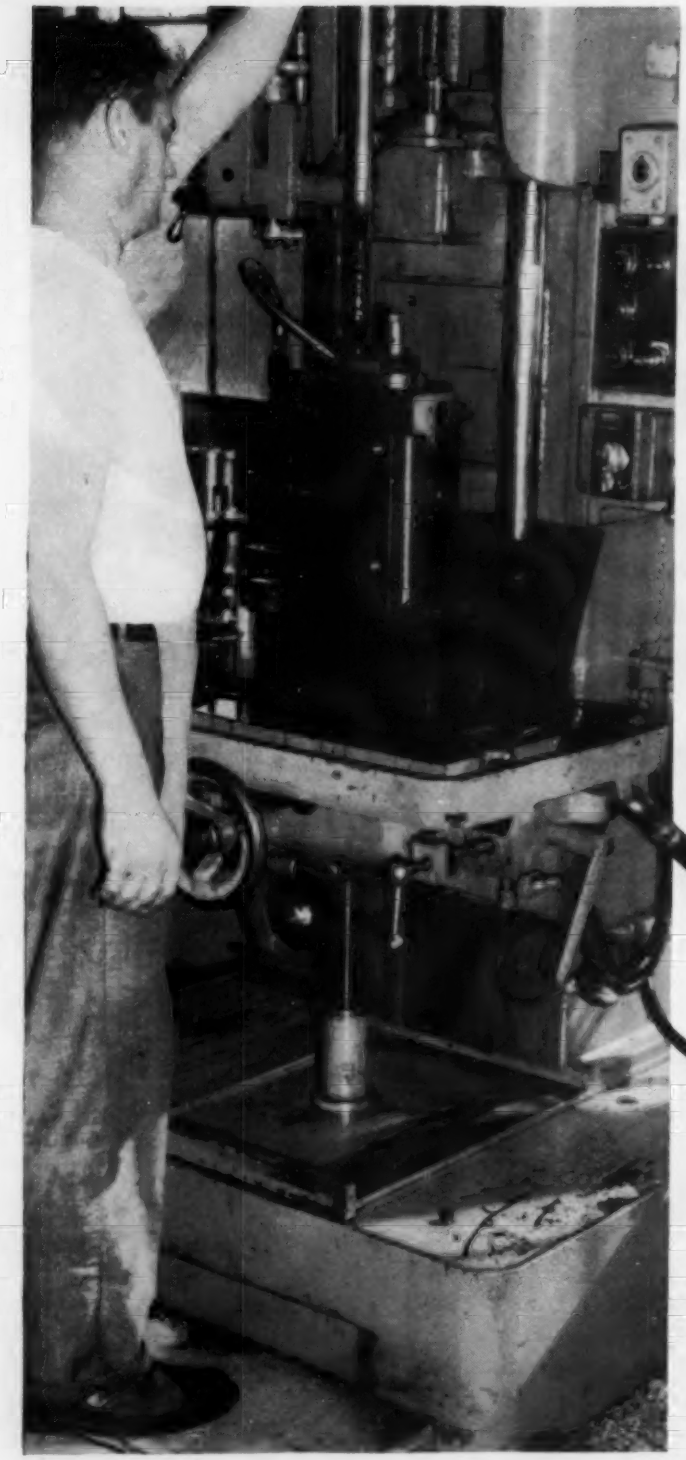

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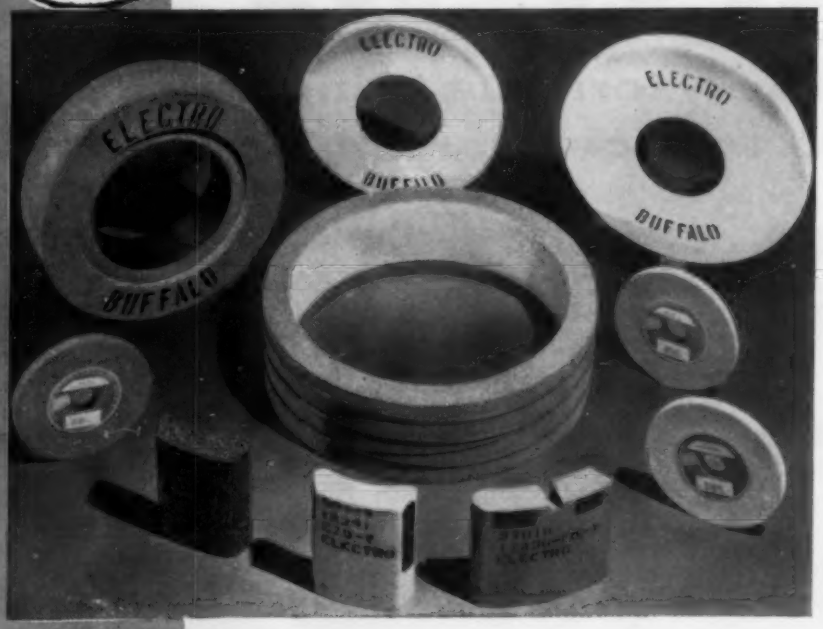

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. . . presents an entirely new type of grinding wheel construction. The unique induced porosity of Electro "20 STRUCTURE" gives wheels and segments a grinding quality particularly desirable for surface grinding.

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- TRUE SURFACE FLATNESS

A TEST

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Letters to the Editor

Surface Finish

On page 23 of GRINDING and FINISHING for September 1956, there is a sentence which reads, "Thus the laws of friction, that the force is proportional to the load, independent of error, and not greatly dependent on surface finish, are explained."

The word "error" does not seem meaningful in this connection. Is it possible that Mr. Reason meant to say "area"?

W. A. Walter, Chief Buyer
Remington Arms Company, Inc.

Reader Walter is right. For unlubricated or dry surfaces, friction both in amount and coefficient is independent of the areas in contact, as long as pressures are moderate. The text of the article should have read, "independent of area".

We have benefited greatly from R. E. Reason's article, "Significance and Measurement of Surface Finish". We would like to receive reprints of the series of articles, if possible.

J. W. Kensington
Livonia, Mich.

Reprints of Mr. Reason's informative series will be available after this month's concluding part of the article appears. Address Grinding and Finishing, 222 E. Willow Ave., Wheaton, Ill. Please allow us a little time to obtain a supply of reprints.

Standard Time Data

Certainly there is a lot of valuable information in Mr. Cyrol's article which appeared in the October issue and, as brought out in your editorial, the data can be utilized for any size plant.

Our grinding costs are being reduced through recommendations taken from the excellent material in GRINDING & FINISHING.

Our thanks for your help.

I. W. Killian, Vice President
Pines Engineering Co., Inc.

We would appreciate your sending us the full series of articles on "Grinding Standard Data" by E. A. Cyrol as soon as possible.

As you know the complexities of grinding have defied standard data formulation for some time. We are sure that your articles will prove to be a

helpful guide to our own objectives.
Eugene M. Kamy,
Industrial Engineer
Teletype Corp., Chicago

Will you please send me two copies of the reprints of E. A. Cyrol's series on standard data.
D. L. Seals, Industrial Engineer
Vickers, Inc., Detroit

Reprints of Mr. Cyrol's series on standard time data will be available on completion of the series.

Information, Please!

We would appreciate your advice on locating manufacturers of grinding machinery to bevel and edge 50 millimeter flat glass lenses and 2" x 4¼" lenses.

The type of machines we are looking for are production machines hooked up to a common drive, whereby one operator would run a bank of machines. This work is not the precision optical variety but simple edging and chamfering.
F. R., Gen. Mgr.
Brooklyn, N.Y.

Please let us know the names and the addresses of manufacturers of small, benchtype internal grinding machines. We now have large internals but need a small machine for our small parts. Any literature or additional information would be appreciated also.
F. A. G., Jr.
Poughkeepsie, N.Y.

Any information you have for these readers would be appreciated. Send the information to GRINDING & FINISHING, 222 E. Willow Ave., Wheaton, Illinois

Work Holders and Drivers

Are reprints of Mr. Conn's article, "Work Holders and Drivers" available? If so, we would like to have three copies for our reference files.
J. D. Manson
Detroit

Yes, Harry Conn's article, "Three recent developments in work holders" is now ready in reprint form. Address GRINDING & FINISHING, 222 E. Willow Ave., Wheaton, Illinois.

One of our engineers is interested in the following:

"Classifying Tool Steels by Grinding Characteristics" by Weir, GRINDING and FINISHING, V. 2 No. 3, July 1956.

We would appreciate your sending us tear sheets or reprints of this article, if available.

Please send to the address as shown above, to the attention of the library and giving the request number for identification purposes.
C. S. Iden
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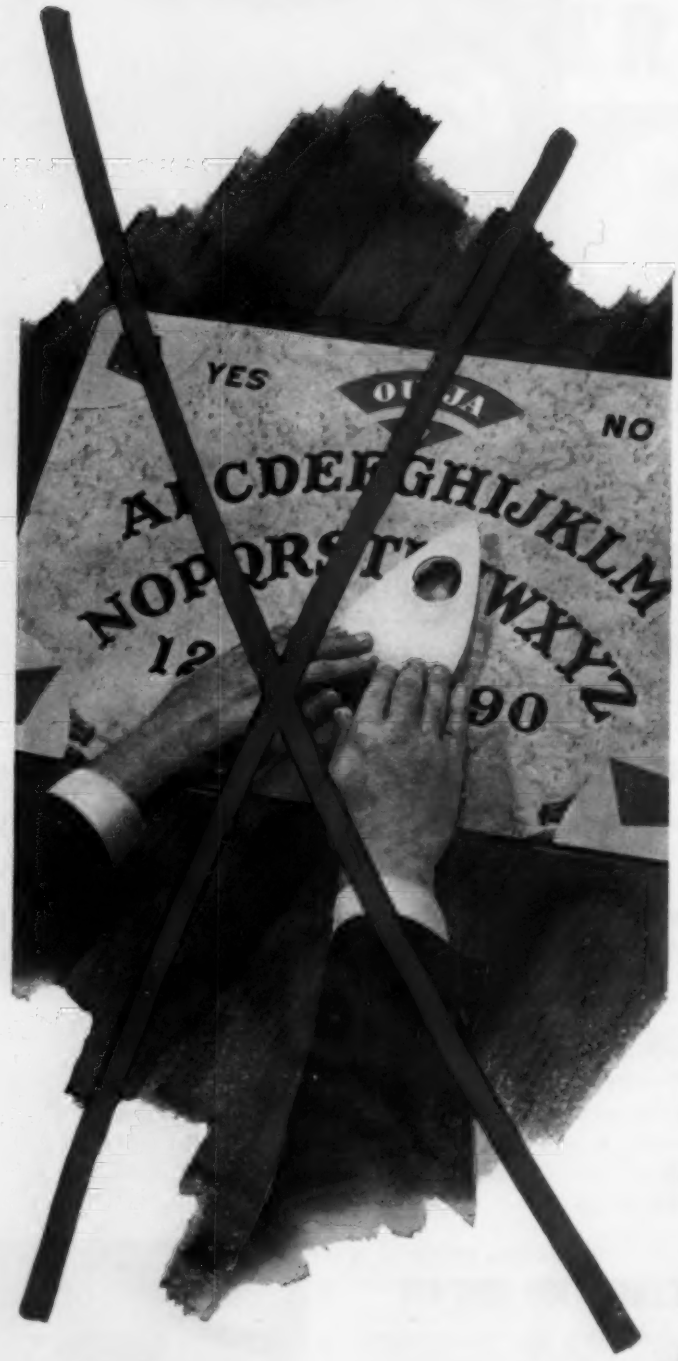
Ouija boards are passé



Time was, when a person had a question, out would come the ouija board for an answer. This wasn't too accurate a system, of course . . . but a lot of people put a lot of faith in what the ouija board told them.

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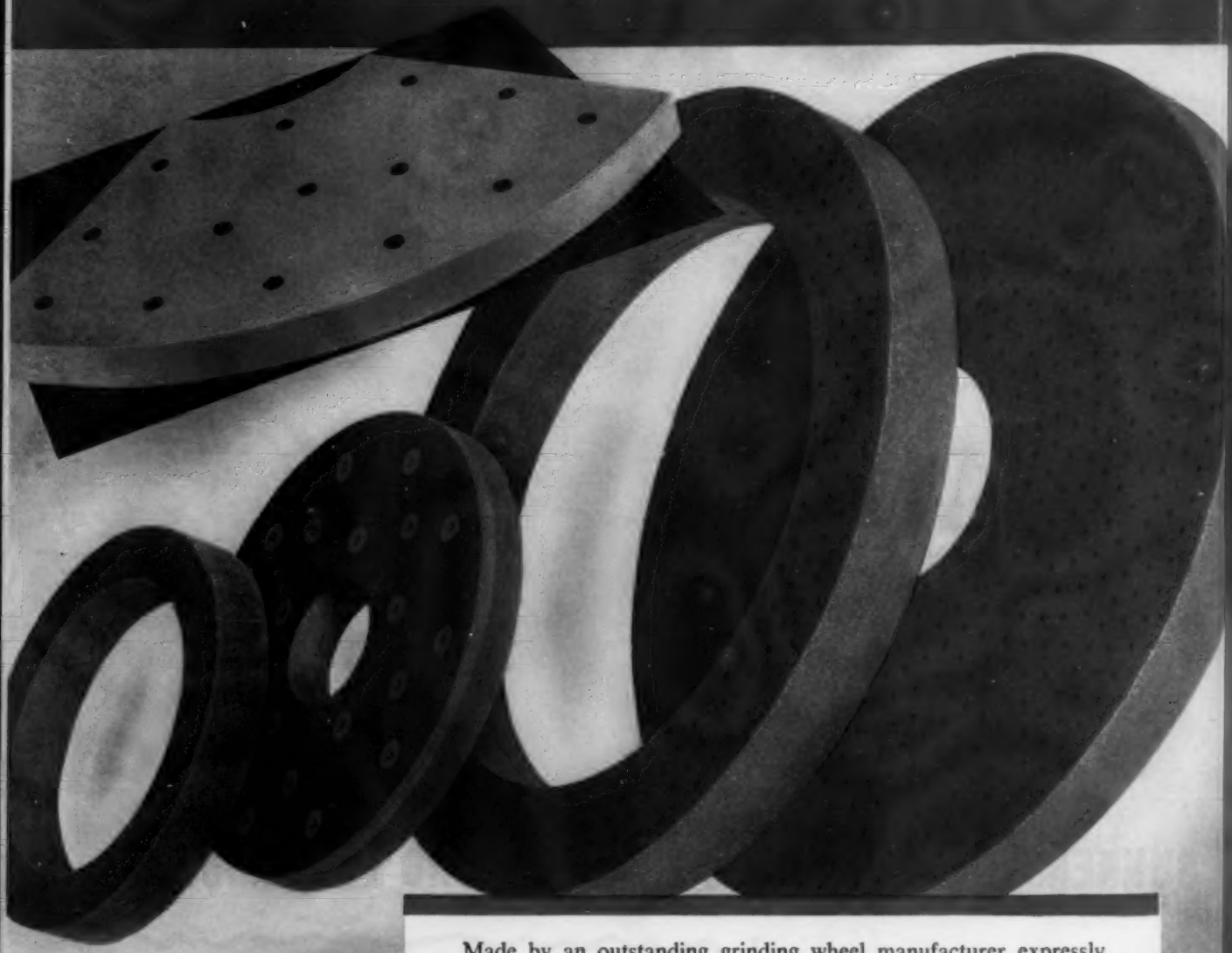

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b. **Check its calibration** using any number of masters. Confirm the fact that only one master is needed. See how dependable the Dimensionair really is.

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"Bowgage" Production Grinders

Out Perform Them All for Speed, Accuracy and Low Cost Grinding

Van Norman "Bowgage" 4BG2 double head plunge cut chucking grinder. Capacity: 6" swing double work head. Grinding wheels: 30" x (¾ to 6) x (12 or 20). Grinding wheel motor: 10 to 20 H.P.

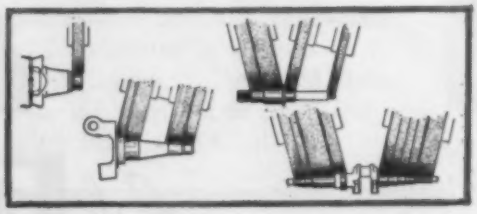
Grinding Universal joint flange on the Van Norman "Bowgage" 4BG2 .022 stock removal — 1.625 diam. — 15 R.M.S. — Maximum 480 pieces per hour.

You just can't beat Van Norman "Bowgage" Production Grinders for fast, economical mass production. These massive, rugged grinders are "*engineered for the job*" to meet your exacting requirements.

Illustrated is the Van Norman "Bowgage" 4BG2 double head plunge cut grinder designed and built for a major automotive manufacturer. Day after day, this 14.8 ton rugged brute and other single and double head grinders are showing substantial savings by keeping production up and costs down.

If you have a mass production grinding problem, let Van Norman Engineers help you solve it. Write for their help, today.

Don't wait . . . for extra profits install a Van Norman Machine now! They are available on many purchase plans—Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . See your dealer or write Van Norman Company. Conditional Sales Contracts not available to Export.



Sketches illustrate actual grinding applications performed for users of single and double head plunge cut special purpose grinding machines.

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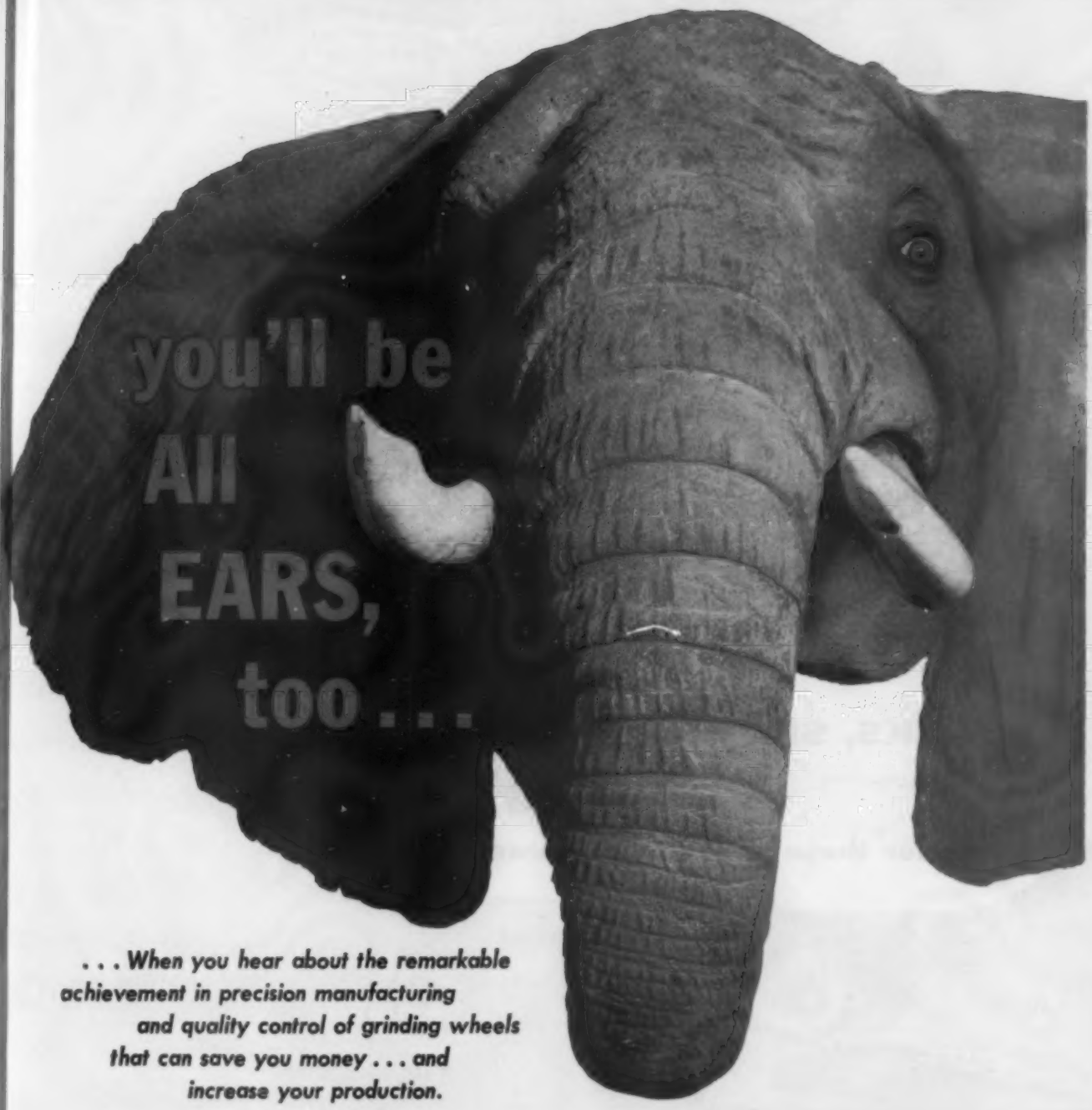

. . . When you hear about the remarkable achievement in precision manufacturing and quality control of grinding wheels that can save you money . . . and increase your production.

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Through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

So, if you don't have an elephant's memory, make a pencil note to contact your CINCINNATI Grinding Wheels distributor. Or, contact us direct and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

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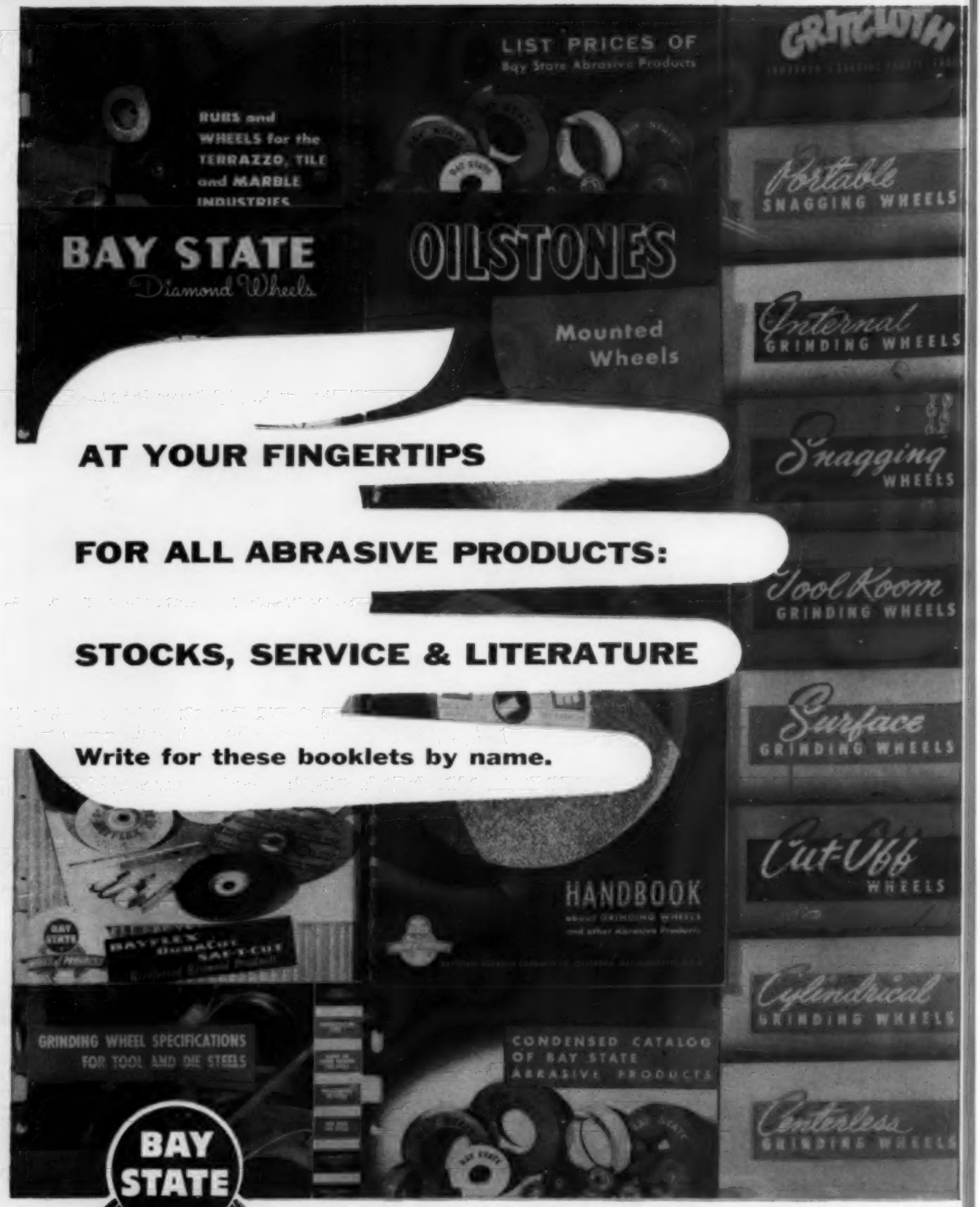

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Machine Tool Company

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"Tomorrow's materials

Norton electric furnace products meet today's needs . . . will meet tomorrow's needs . . . for ever higher temperature applications.

Space travel will some day be a reality.

But first, new materials must be developed. Electrochemically refined materials that will endure higher temperatures, for longer periods of time, than any now commercially available. Materials, also, that will withstand conditions as yet unknown.

As the world's largest manufacturer of abrasives, Norton has long pioneered in electric furnace techniques. This has resulted in grinding wheels, abrasive grains and other abrasive products of exceptional strength, hardness and efficiency. It has also led to the development of new electrochemically refined materials to meet

Where New Materials Are Born. In Norton electric furnaces, abrasives and other materials with combinations of qualities and characteristics not found in natural substances are evolved.

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NORBIDE* Control Rods for reactor pile are Norton-processed from boron carbide. The hardest material made by man for commercial use, NORBIDE boron carbide has many other applications.

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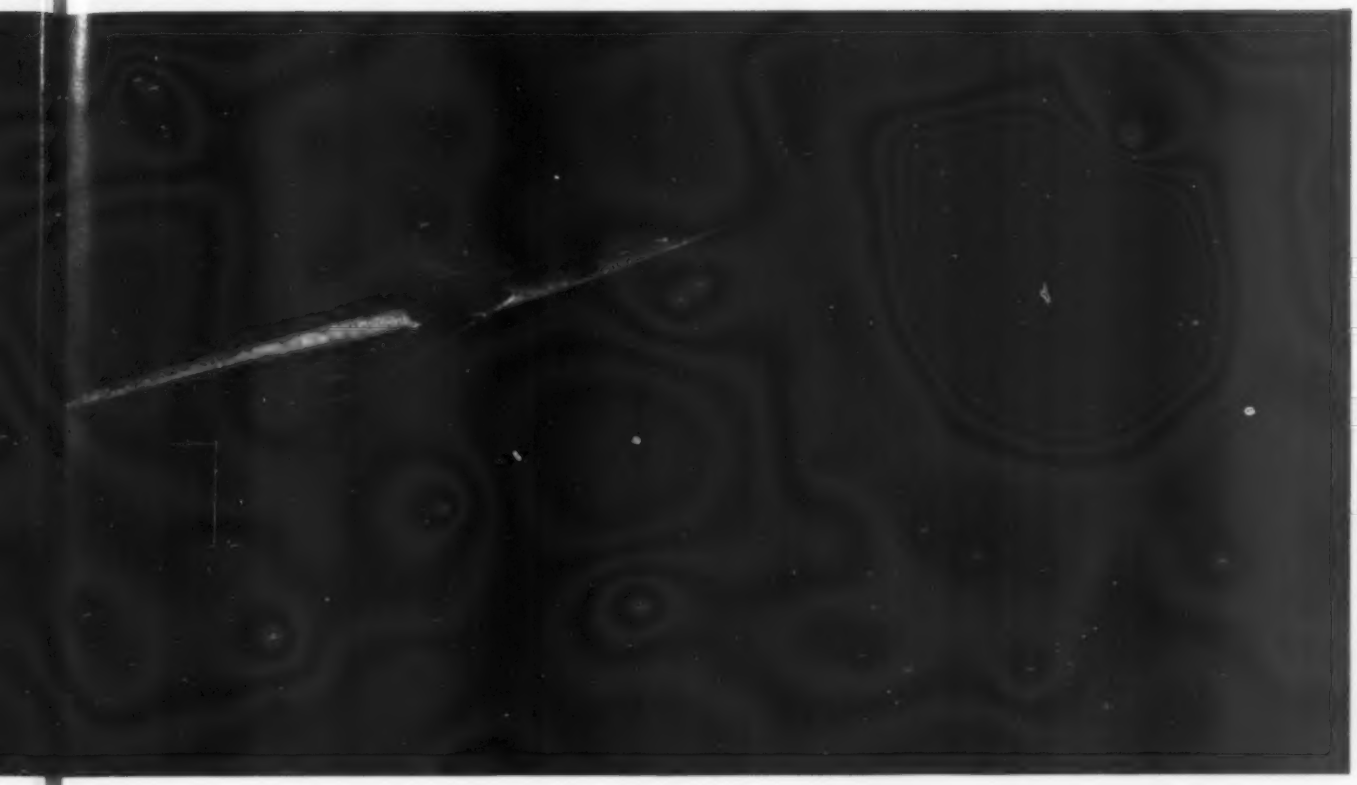

ls will be found..."

industry's constantly increasing needs.

Another result is that Norton now supplies a wide range of products for high-temperature applications, including rocket and jet plane propulsion, thermal barriers and atomic energy equipment.

The search for tomorrow's materials is a constant, daily job in Norton laboratories. Behind this project are the research, engineering and manufacturing resources of a world-wide organization. The materials will be found.

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First In Abrasives. Abrasives — in particular, Norton grinding wheels and Behr-Manning coated abrasives — are Norton's principal products. Norton also manufactures the most complete line of precision grinding machines and a broad line of refractory materials, including products for the AEC.

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Abrasive and Grinding Wheel Plants — Worcester, Mass.; Santa Clara, Calif.; Hamilton, Ontario; South Africa; England; France; Germany; Italy. **Behr-Manning Plants** — *Coated Abrasives and Behr-cat Tapes* — Troy, N. Y.; Canada; Australia; France; Northern Ireland; Argentina. **Electric Furnace Plants** — Huntsville, Alabama; Chippawa, Ontario; Cap-de-la-Madeleine, Quebec. **Grinding and Lapping Machine Plant** — Worcester, Mass. **Refractories and Electro-Products Plant** — Worcester, Mass. **Norton Pike Plant** — *Sharpening Stones* — Littleton, New Hampshire. **Bauxite Mines** — Bauxite, Arkansas.

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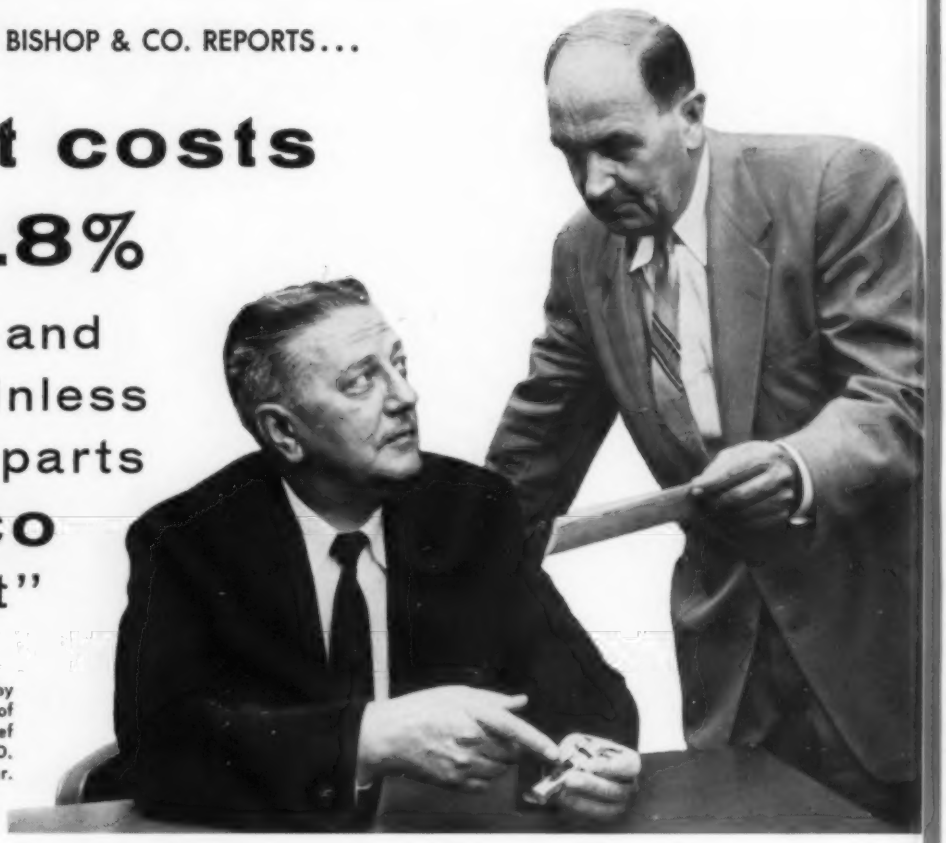
"We cut costs 98.8%

by deburring and polishing stainless steel tubular parts with ALMCO equipment"



SAVINGS OF $6,917.50 PER YEAR by controlled barrel finishing is the topic of discussion between J. H. Gettig, Chief Engineer of J. Bishop and Co., and O. D. Ladley, Almco Eastern Branch Manager.

HALF A MILLION delicate parts for recording instruments and fountain pens are deburred and polished each year at J. Bishop & Company of Malvern, Pennsylvania. Each must meet rigid requirements in uniformity of size, smoothness and high polish.

A costly process? Yes, when you consider the way Bishop used to finish them by machine reaming, hand scrapers, wire brushes and belt polishers.

Today this plant uses an Almco Model DB-200 finishing barrel, which gives three important advantages: (1) High volume, low cost deburring and finishing, (2) precise control during finishing process, (3) product improvement.

Here's how controlled barrel finishing worked out for J. Bishop & Company. They cut finishing costs by 98.8% ... practically eliminated rejects ... raised average output from 200 parts to 6000 parts per hour. Cost per unit for finishing has been cut from .014¢ to .00016¢. Annual savings total $6,917.50.

Chief Engineer J. H. Gettig sums it up this way, *"Our decrease in costs and our product improvement leaves no basis for comparison."*

PART OF A HALF MILLION ANNUAL OUTPUT, this batch of delicate instrument parts is being run in an Almco DB-200 barrel finishing machine.

Almco equipment is also used throughout the world for descaling, grinding, work-hardening, rust-inhibiting and other deburring and finishing operations. Equipment is available for small and large parts, high or low volume work. Each is designed to handle ultra-low microinch surfaces and close tolerance radii.

LEARN HOW MODERN BARREL FINISHING CAN IMPROVE YOUR PRODUCT

Almco's new, technician-staffed lab in Albert Lea, Minnesota can help you with your product parts. We will examine your product parts, run them through tests, and come up with the answers you want. For example — where you can save finishing costs, how you can improve product quality and appearance, what method is best for your operation.

Why not send us your sample parts? Enclose specifications on the results you want. Or write us on your company letterhead requesting an Almco engineer to call on you.

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52 pages of facts and processes on barrel finishing. Shows typical installations, how to select the proper finishing barrel. Includes detailed cost chart on finishing of typical parts. Send for your free copy today.

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Bring Automation Into the Open

We agree wholeheartedly with the point made by Mr. H. E. Nason, Westinghouse Chicago District Manager of Engineering, at the recent International Harvester automation conference. Industry hasn't really explained automation to the American people. This developing technology to which we already owe so much and which promises to further increase our standard of living is still a strange thing to the man on the street.

Mr. Nason put the case very clearly. "Afraid of borrowing trouble, industry has been slow with its word on automation, far too slow. Now we find ourselves in the rather ridiculous position of having to defend a manufacturing technique that is not only logical but absolutely necessary to the growth and well-being of our country. Labor has argued that industry has shrugged its responsibility as Americans by allowing automation to grow. The only responsibility that industry has shrugged is that of communicating to the people what automation is and what its effects will be. This is the challenge of every segment of industry that is at all connected with the growth of automation: to use every means at your disposal to make evident to the American people what automation is, how it has come about, and what it will result in."

As production management men, responsible for the installation of production facilities—including automated equipment—you can communicate these ideas to the people you know. Tell them that automation is the only way we can meet demands for increased production at a time when the skilled labor supply is limited. That automation, far from insuring higher profits for industry, requires a much larger equipment investment per worker. That the consumer is the one who benefits most from automation, in the form of lower prices for the things he buys.

As Mr. Nason says, "Automation is not a social plague—it is an economic necessity."

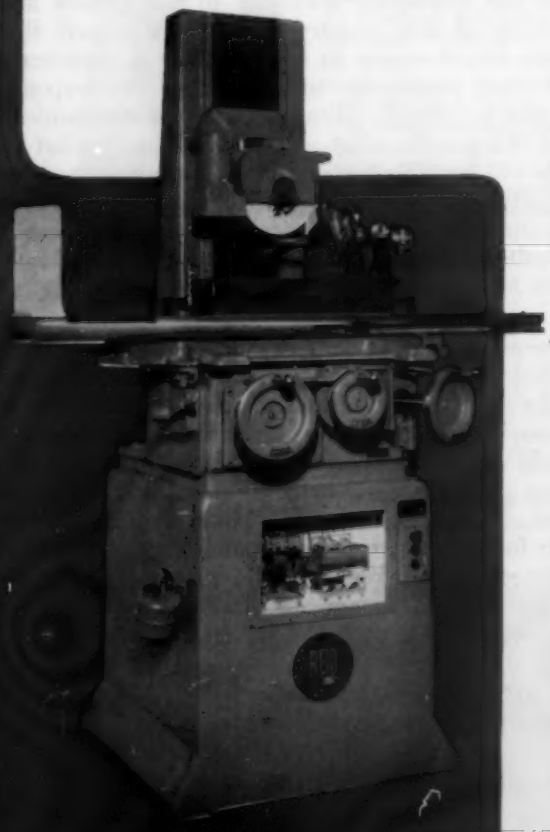
Let's make sure our friends know that fact.

Jack Kenyon
Managing Editor

PRECISION REID SURFACE GRINDERS

SETS THE STANDARD *for Precision* SURFACE GRINDERS

MODEL 824 Reid-O-Matic with push-button controls for fast selection of all grinding operations and quicker set-up and changes. Outstanding features, for production and toolroom grinding, include: finger-tip level controls, electrical components in single, sealed base housing for easy access, and adjustable gibs on head ways.



Specifications:
Capacity — 8"wide, 24" long, 15" high
Worktable — 66" by 10¼" overall
Table speed — infinite variation, 0 to 75 fpm.
Feed range — elevating mechanism, to .0005"; vernier, to .0001"
Spindle — 2 H.P., 1800 rpm. (std. cartridge type)

MODEL 618 — the standard for truly precise toolroom grinding. Features include: rugged construction with one-piece column, cogged timing belt for smooth table operation and sealed cartridge type motorized spindle for smooth chatter-free operation.

Specifications:
Capacity — 6" wide, 18" long, 17¼" high
Worktable — 51" by 8" overall
Table speed — infinite variation, 12 to 35 fpm.
Feed range — elevating hand wheel-to .0005"; cross feed — to .001"
Spindle — 1 H.P., 3450 rpm.

For full details and specifications write for Bulletin 800

Reid Brothers Company, Inc.

BEVERLY MASSACHUSETTS

grinding — finishing
NOVEMBER 1956

International Harvester engineers were shown latest techniques–

"Progress Thru Automation"

conference held in Chicago

by **Jack Kenyon**
Managing Editor

● International Harvester Company has just concluded a very effective series of "Progress Through Automation" conference for its key engineering and manufacturing personnel to give them an insight into the use of automated processes and facilities, and to tell them what Harvester top management thinks about automation. About four hundred Harvester men from all the company's divisions attended the two-day sessions of the conference at the company's Manufacturing Research Laboratory in Chicago. They heard recognized automation authorities talk about new developments in detail, and they saw the latest in automated machines and equipment demonstrated.

As the manager of manufacturing research, W. D. Bryson, pointed out, International Harvester has metalworking operations ranging from high volume mass production to large job shop operations. Harvester is interested in applying automation to any of these operations, wherever it will:

1. Reduce costs
2. Improve quality
3. Make operations safer
4. Improve working conditions

"One of our main ideas in having the conference was to assure ourselves that our technical people know what management thinks about automation," explained Bryson. "In other words, we're establishing a channel of communication between executive management and our production engineers on the subject of automation." He also explained that Harvester management wanted its engineers to be stimulated by seeing the very latest in automated equipment in action.

The National Machine Tool Builders Association helped in a very real way to make the conference a success, by lining up an imposing array of machine tools to be shown and demonstrated. Other equipment makers also had their devices there, such as computing, gaging and sorting equipment.

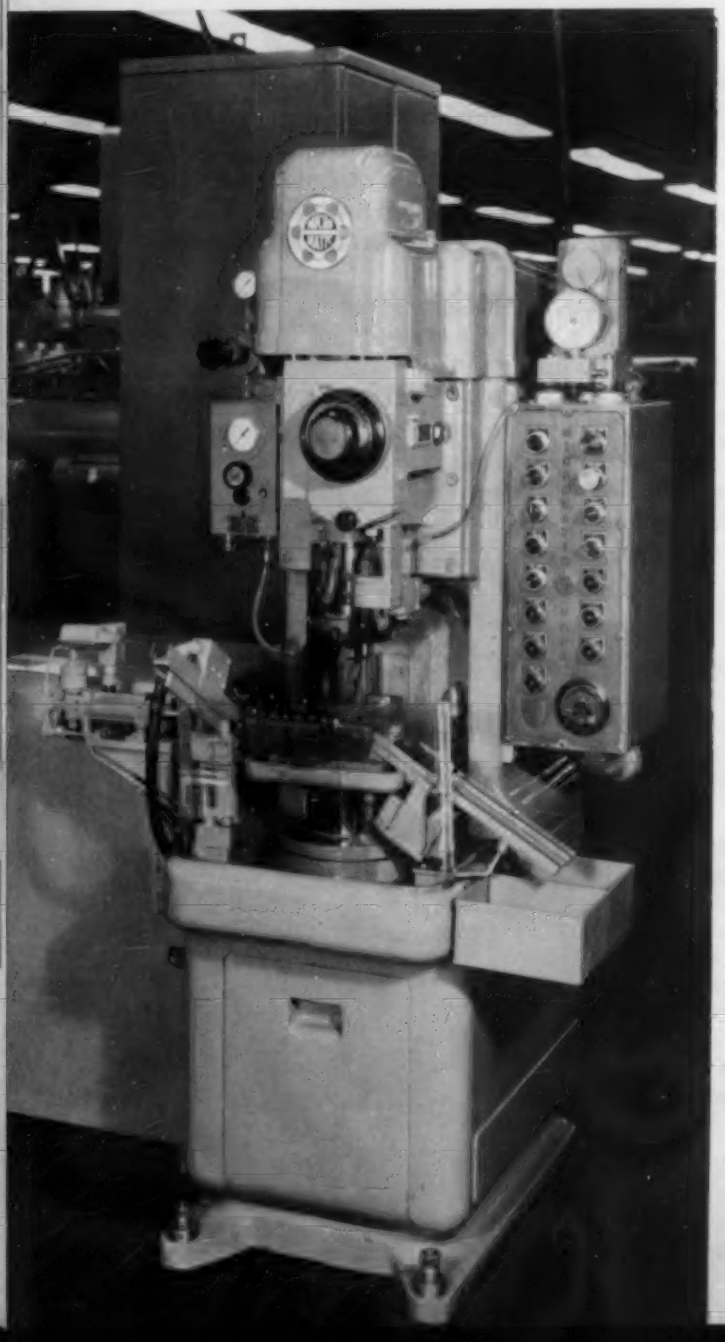
Demonstrations and the addresses by authorities were worked into a close but somewhat flexible schedule, so that production men engaged in a spe-

FEDERAL PRODUCTS GAGING, SORTING AND FEEDBACK unit for after-gaging of ground parts can be used to control output of internal grinder. Unit actually accomplishes presetting of machine compensation, can be used in connection with plug-type in-process gage checking parts as they are ground.

cialized process or type of machining could devote as much time as necessary to examination of the equipment that was of interest to him. Operations varied all over the lot, and included foundry processes, heat treatment, machining, welding, materials handling, packaging and many others. The grinding and honing operations were very interesting, ranging from toolroom grinding to production grinding of mass-produced parts. Feedback control of some of the grinding machines was featured, and other forms of gaging and automatic sizing were in evidence.

Equipment Selection Emphasized

To make sure that the money spent for facilities is spent wisely, conferees were urged to keep abreast of the rapidly evolving technology of automation. Mr. R. C. Archer, Vice President, Manufacturing, brought this out very forcefully by saying, "We must base our selection of equipment on the soundest kind of judgment of present and future need. If this is done by all who are concerned with the selection of equipment, Executive Management will be able to make its decision in a way calculated to best serve all of the varied interests of the Company."



THIS MICROMATIC HONE MODEL 738-C "Hydrohoner" was in operation at the conference. It had automatic loading, unloading and gaging equipment and was honing ID of inner bearing races in an automatic cycle. Automatic stone feed was a feature.

Engineering-Manufacturing Co-ordination

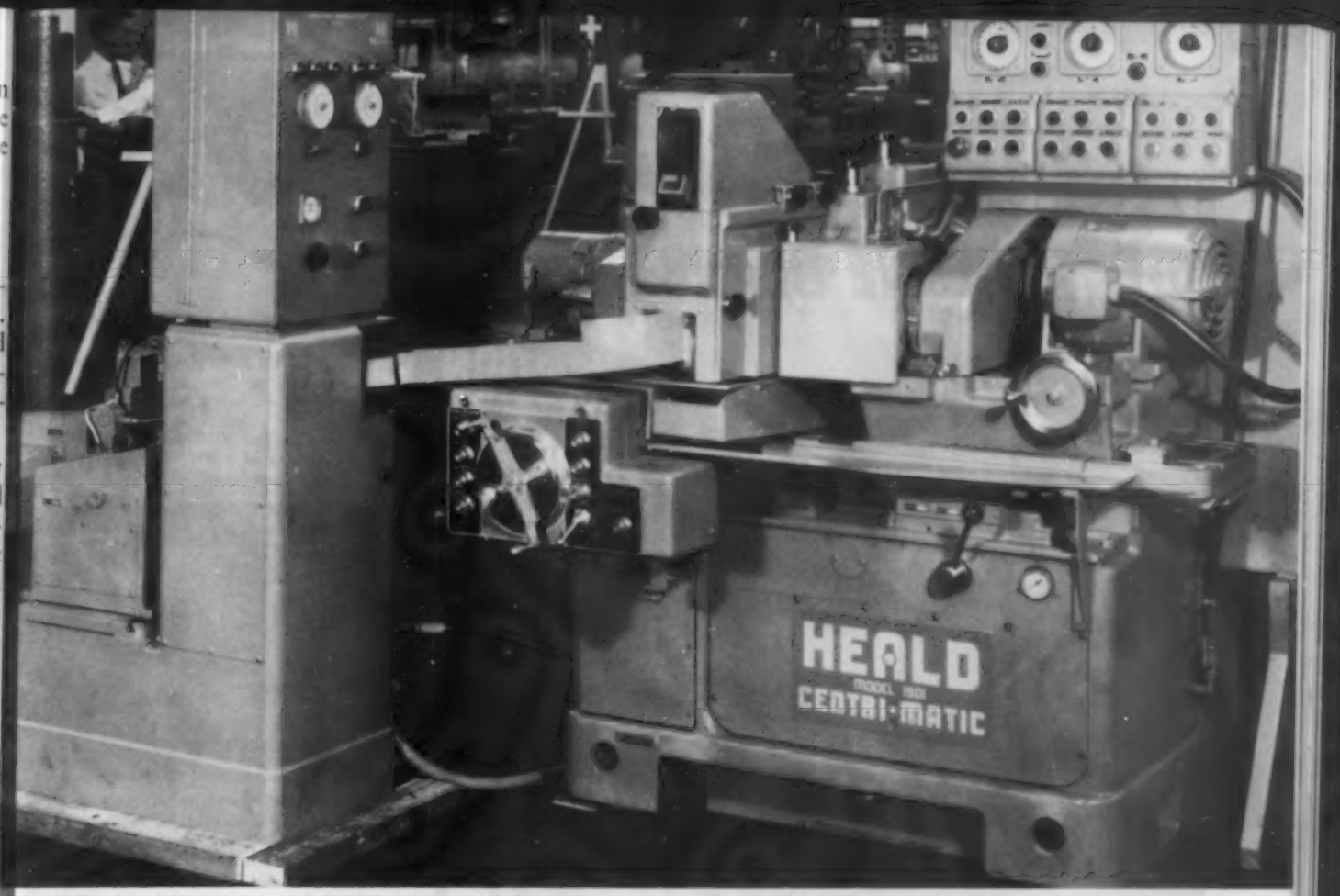
Mr. A. E. W. Johnson, Harvester Vice President—Engineering, told conferees, "It is mandatory . . . that product engineering have knowledge of, and ability to create designs, utilizing the latest developments in machine tools, equipment, and other advanced manufacturing techniques."

Mr. Johnson also pointed out that automatically controlled machines in many instances permitted working to closer tolerances. "Parts can be economically manufactured to closer tolerances through the use of new types of gages and controls that will often permit designs either impractical or impossible in the past. Moreover, automatically controlled equipment minimizes the buildup of tolerances and will avoid in many instances the need for selective assembly."

Other Addresses

Following the addresses by Mr. Archer and Mr. Johnson, conferees were given "A Good Look at Automation" by Dr. H. B. Osborne, Jr., Tocco Division, Ohio Crankshaft Co., and by H. E. Nason of Westinghouse. Dr. Osborne reaffirmed the statement that automation isn't just a way to beat increasing labor costs. He said, "Contrary to popular conception, automation has not been so widely adopted by industry to increase production in a rapidly rising labor-cost era, but rather is a necessity of our modern times which finds fewer skilled hands to satisfy the tremendous demands for products of uniformly high quality." He went on to show that automation has been evolutionary rather than revolutionary—that it's merely an extension of what has been going on for quite a while. In regard to the machines used in automated plants, Dr. Osborne reported, "A new concept of 'standards' may be necessary with automation. Rather than having fixed values, 'standards' as applied to automated processes and equipment may have a range of values to permit reasonable future product variations without obsoleting the automated equipment. 'Standards' must have versatility and flexibility."

"Mechanics of Automation" was the topic of Dr. Gerhard A. Nothmann, Manager of the Mechanical Engineering Research Department, Armour



ONE OF THE MACHINES DEMONSTRATED at the Harvester conference was this Heald Model 1901 shoe-type centerless internal race-way grinder, equipped with Federal Products feedback gauge sizing. Part being ground was the outer race of International Harvester type 217 ball bearing. Gaging of the races, done after the part is ground and is in the discharge chute, corrects the machine as soon as a measurable trend toward tolerance limits is detected by a variation in air reading.

Research Foundation. Dr. Nothmann, long a recognized authority on automation, said that the automation engineer of today must be able to use the new language of automation, including terms such as "feedback, gain, digital, analog, response characteristics. . ." and so on. Further, the engineer should be able to explain these terms to the uninitiated.

As Dr. Nothmann put it, "About ten or fifteen years ago, when renewed emphasis was placed on automation development, and, particularly, when many of the modern techniques of servomechanisms and computers were applied to automation, it was found that much of the theory of these new systems was already well developed. These methods were well advanced in the field of communication and network theory with which most electrical engineers are familiar. Consequently, much of today's automation terminology is taken from this area. This fact, indeed, can be a source of frustration to those of us who bring a mechanical engineering background to automation. We may perhaps take encouragement from a famous reply which O. Heaviside, one of the fathers of modern network theory, gave to a group of mathematicians. He was questioned about the validity of applying his methods, useful and accurate though they had been found to be, without providing rigorous mathematical proofs and derivations. His classical question in answering this criticism, was, "Should I refuse my dinner because I do not fully understand the process of digestion?"

"Servo and Feedback Principles Explained" was the topic on which Tracey E. Johntz and Fred L. Kahl, application engineers of General Electric's Chicago office, spoke. Down-to-earth analogies of these seemingly complicated subjects were given to illustrate feedback principles. Feedback was shown to be the key to many kinds of self-regulating machines. The automatic grinder of today which employs control gaging equipment demonstrates this type of function.

"Automation—an Aid to Quality Control" was the subject of presentations by L. O. Heinold and R. A. Souler of Federal Products Corporation. Their addresses showed the importance of automatic gaging to automation. Various types of gaging systems were explained with their application to automated processes. J. S. Broatch of Pratt & Whitney and Prof. H. R. Swenson of the Industrial Engineering Department of Illinois Tech also dealt with quality control aspects of automation.

Other speakers of the conference spoke on materials handling, foundry and welding operations which could be automated. ● ● ●

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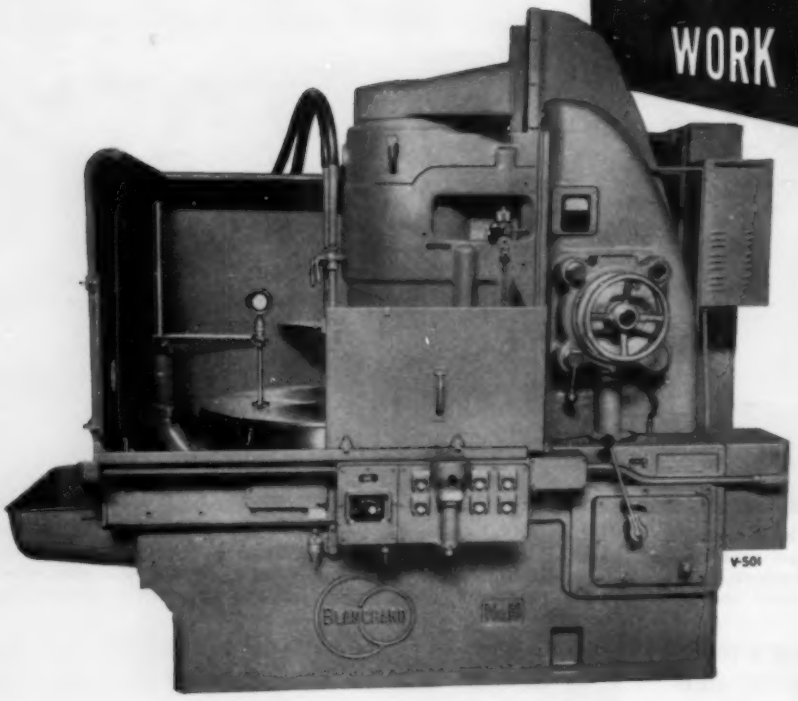
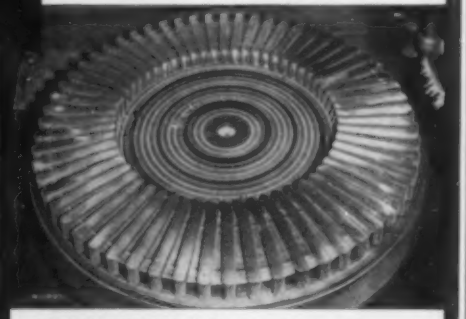


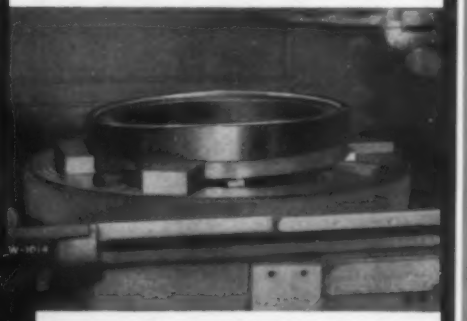
PRODUCTION WORK

SIDE PLATES. 9" x 18" plates ground from rough on No. 18 Blanchard with 36" chuck. Stock removal 1/16" to 1/8" per side. Held flat within .003", parallel to .001", and to dimension tolerance of ± .001". Production: 30 surfaces per hour.



CONNECTING LEVERS. Cast iron levers ground in special magnetic fixture with pins located in "vee's". Stock removal per side is 1/32" to 1/16"; must be flat and at right angles to pins. No. 18 production: 180 pieces per hour, compared to 20 pieces per hour by former method used.

MAINTENANCE AND ODD LOT WORK



HARDENED STEEL PUNCHES. This 24-13/16" dia. punch, reground on a No. 18, is centered radially on 36" magnetic chuck. Duplicate circumferential and radial shear reliefs are generated with two setups.

GRANITE SURFACE PLATES. A No. 18 Blanchard reconditions this 18" x 34" granite surface plate by grinding it flat within .0002". 3/16" of stock is removed in 5 hours.

Blanchard Grinders are used throughout industry on surface grinding jobs that demand the utmost in production, finish and accuracy.

Whatever *you're* surface grinding, there's a Blanchard designed to do the job speedily and accurately.

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Send for free copies of "Work done on the Blanchard", fifth edition, and "The Art of Blanchard Surface Grinding".

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Developing Standard Time Data for Grinding Operations

Part 2

Standard Data for Plunge Center-Type Cylindrical Grinding

by **E. A. Cyrol**
E. A. Cyrol & Company
Management Consultants

Here's the second of a series of standard data studies which the author has made for different classes of grinding.

In Part 1 last month Mr. Cyrol showed that grinding is ideally suited to estimating methods based on standard time data. Standard data offer both small and large shops a very accurate and consistent means of obtaining production standards.

Last month the method of establishing standard data was discussed in detail. These steps can be outlined as follows:

1. *Take a large number of time studies of the operation, carefully describing all the elements and recording their time values.*
2. *Post the time study values to comparison sheets, where constant and variable elements of the operation can be quickly spotted.*
3. *Analyze the data for constant and variable elements. Look for possible methods improvements in the operation and incorporate them in the standard work cycle.*
4. *Perform a check study to determine the accuracy of values found in the analysis.*
5. *Write up the final study in permanent form, including detailed element descriptions, tables of time values, etc. Prepare a standard data work sheet for convenience in calculating production standards.*

A sample study made by this method, standard data for Blanchard No. 18 operations, was also included in part 1. The sample studies can serve as a guide to plants developing standard data for their operations.

This month's sample study is on center-type cylindrical plunge grinding on several makes of machines.

● Among grinding operations which estimators complain most about are center-type cylindrical work. In our studies, though, they've proved to be entirely suitable for standard data development. The data presented in this and succeeding parts of the article were obtained in an extensive study in one plant which does grinding of all types.

The machine types available for our between-centers study were as follows:

1. Norton C-6x18 Plain
2. Norton C-14x48 Multi-purpose
3. Norton CTU 6x18 Plain hydraulic
4. Norton C-6x24 Plain hydraulic
5. Norton C-6x18 Plain hydraulic
6. Cincinnati No. 3—6x18
7. Landis 4H 4x18 Plain
8. Brown & Sharpe No. 1—10x20 Universal
9. Brown & Sharpe No. 2—14x30 Universal
10. Brown & Sharpe No. 5—3x18 Plain
11. Brown & Sharpe No. 20—10x18 Plain

We have divided the elements involved in the study into four groups:

1. Piece handling elements for automatic and hand operated grinders.
2. Machine handling elements for automatic grinders.
3. Machine handling elements for hand operated grinders.
4. Additional elements which may occur in either type.

Piece Handling Elements—Automatic and Hand Operated Grinders

The elements listed below and their descriptions cover in detail the work done by the operator to perform each element. The values shown represent the amount of time allowed for the average operator working at a normal pace to execute the element properly.

1. **Position and Remove Dog.** **.080 Min.**
This element includes time allowed for the operator to position dog on piece, and tighten with dog wrench, and loosen dog with dog wrench and remove dog.
2. **Pick Up and Aside Piece to Skid.** **.046 Min.**
This element includes time allowed for operator to pick up piece from skid to table before grind and remove piece from table to skid after grind.
3. **Grease Centers.** **.045 Min.**
This element includes time for operator to apply lubricant to centers of work piece. Use only when observed on floor as necessary.
4. **Gage Piece.** **Refer to Gauging Chart**

Note: The above elements generally occur in every piece. When grinding on hand operated machine the total time is used only when the total piece handling time is greater than lap out time. When grinding on automatic type grinder use total piece handling time when it exceeds the grind and lap time.

Machine Handling Elements—Automatic Type Grinder

The elements listed below and their descriptions cover in detail the work done by the operator to perform each element. The values shown represent the amount of time allowed for an average operator working at a normal pace to execute the element properly.

1. **Pick Up and Aside Piece.**
Table to Machine. **Refer to Chart No. 5**
This element includes time allowed to pick up piece from table and move to the machine centers, approximately 18″ distance, and move piece from centers and place on table.
2. **Place and Remove Piece on Centers.** **.077 Min.**
This element includes time allowed for the operator to depress tail stock lever, seat piece between centers, release tail stock lever, depress tail stock lever, remove piece from centers and release tail stock lever.
3. **Advance Wheel to Grind.** **.036 Min.**
This element includes time allowed for operator to actuate the feed lever and for the wheel to advance to grinding position.
4. **Retract Wheel from Grind.** **.030 Min.**
This element includes time allowed for operator to actuate the feed lever and for the wheel to retract to clear position.

Note: Elements of start and stop workhead and start and stop coolant are not used on automatic type grinder. When operator actuates the feed lever, it automatically starts and stops workhead and coolant.

Diameter		Time Per .001 Stock
Over	Thru	
0	.250	.012
.250	.550	.015
.550	.850	.020
.850	1.150	.024
1.150	1.450	.028
1.450	1.700	.031
1.700	2.000	.035
2.000	2.300	.040
2.300	2.600	.044
2.600	2.900	.048
2.900	3.200	.052
3.200	3.500	.056
3.500	3.800	.060
3.800	4.100	.064
4.100	4.400	.068
4.400	4.700	.072
4.700	5.000	.076
5.000	5.300	.080
5.300	5.600	.084
5.600	6.000	.088

CHART NO. 1—TIME TO REMOVE .001 STOCK, automatic and hand operated grinding. To use chart, select OD being ground in column headed "Diameter" and read time value at right under "Time per .001 Stock." These values are noted on work sheet to the right of their respective OD sizes.

Machine Handling Elements—Plunge Grind Hand Operated Machine

The elements listed below and their descriptions cover in detail the work done by the operator to perform each element. The values shown represent the amount of time allowed for an average operator working at a normal pace to execute the element properly.

Diameter of Work	RPM
.250	1527
.500	764
.750	509
.875	436
1.000	382
1.125	339
1.250	305
1.375	278
1.500	255
1.750	218
2.000	191
2.250	170
2.500	153
2.750	139
3.000	127
3.250	117
3.500	109
3.750	102
4.000	95
5.000	76

CHART NO. 2—RPM SELECTION FOR WORKHEAD. Required workhead RPM to obtain 100 Surface Feet Per Minute under normal conditions. Of course, SFM must be varied from about 65 to 150 according to grinding conditions encountered.

1. **Pick Up and Aside Piece.** **See Chart 12 Page 12**
   This element includes time allowed to pick up piece from table and move to machine centers approximately 18" distance, and move piece from centers to table.
2. **Place and Remove Piece on Centers. .077 Min.**
   This element includes time for operator to depress tail stock lever, seat piece between centers, release tail stock lever, depress tail stock lever, remove piece from centers, and release tail stock lever.
3. **Start and Stop Workhead. .040 Min.**
   This element includes time for operator to move workhead lever up to start and move down to stop.
4. **Start and Stop Coolant. .043 Min.**
   This element includes time allowed for operator to move coolant control lever to on and off positions.
5. **Advance Wheel to Grind. .036 Min.**
   This element includes time allowed for operator to position grinding wheel to work until it sparks.
6. **Retract Wheel from Grind. .030 Min.**
   This element includes time allowed for operator to retract grinding wheel from work to a clear position.

Note: The above elements in every piece on hand operated machine.

Diameter	Time (Min.)
0 to .250	.035
.251 to .500	.065
.501 to .750	.095
.751 to .875	.110
.876 to 1.000	.122
1.001 to 1.125	.134
1.126 to 1.250	.146
1.251 to 1.375	.158
1.376 to 1.500	.170
1.501 to 1.750	.182
1.751 to 2.000	.194
2.001 to 2.250	.206
2.251 to 2.500	.218
2.501 to 2.750	.230
2.751 to 3.000	.242
3.001 to 3.250	.254
3.251 to 3.500	.266
3.501 to 3.750	.278
3.751 to 4.000	.290
4.001 to 5.000	.302

CHART NO. 3—LAP TIME, automatic and hand operated grinding. Select OD being ground in column headed "Diameter" and read time value at right under "Time."

Additional Elements— Automatic & Hand Operated Elements

The elements listed below and their descriptions cover in detail the work done by the operator to perform each element. The values shown represent the amount of time allowed for an average operator working at a normal pace to execute the element properly.

1. **Position Wheel to Shoulder .045 Min.**
   This element includes the time allowed for the operator to position the grinding wheel longitudinally to touch shoulder before removing stock.
2. **Position Table. .075 Min.**
   This element includes the time allowed for the operator to position the table longitudinally to facilitate loading and unloading. Use when piece has a large face or difficult to position and remove from machine, for safety operation.
3. **Stone Corner. .086 Min.**
   This element includes the time allowed for the operator to pick up a stone from the machine table, stone edge of piece while revolving in machine and to aside stone to table. Use when stated in routing.
4. **Grease Centers. .045 Min.**
   This element includes the time allowed for the operator to apply grease to both center holes in piece. This element is allowed only if observed on floor as necessary.

continued

5. Secure Piece in Steadyrest. .100 Min.

This element includes time allowed for the operator to position and secure piece in steadyrest.

Gaging

The gaging time values as listed are based on the time allowed to check one dimension with gage listed.

Sheffield Gage:

1. Under .0005 tol. solid piece — Up to 2" Lgth. .078 Min.
   Gage every pc. one position = .070 Min.
   Gage every 10th pc. (2) additional positions = .008 Min.
   2 x .04 = .080 ÷ 10 = .008 — .078 Min. Total
2. Under .0005 tol. solid piece — Over 2" Lgth. .086 Min.
   Gage every pc. one position = .070 Min.
   Gage every 10th pc. (4) additional positions = .016 Min.
   4 x .04 = .160 ÷ 10 = .016 — .086 Min. Total
3. Under .0005 tol. thin wall piece — Up to 2" Lgth. .086 Min.
   Gage every pc. one position = .070 Min.
   Gage every 5th pc. (2) additional positions = .016 Min.
   2 x .04 = .080 ÷ 5 = .016 — .086 Min. Total
4. Under .005 tol. thin wall piece — Over 2" Lgth. .118 Min.
   Gage every piece one position = .070 Min.
   Gage every 5th pc. (6) additional positions = .048 Min.
   6 x .04 = .240 ÷ 5 = .048 — .118 Min. Total
5. .0005 thru .001 tol. — Up to 2" Lgth. .019 Min.
   Gage every 5th piece one position .07 ÷ 5 = .014 = .014 Min.
   Gage every 15th pc. (2) additional positions = .0053 Min.
   2 x .04 = .08 ÷ 15 = .0053 — .0193 Min. Total
6. .0005 thru .001 tol. — Over 2" Lgth. .030 Min.
   Gage every 5th piece on position .07 ÷ 5 = .014 = .014 Min.
   Gage every 10th pc. (4) additional positions = .016 Min.
   4 x .04 = .16 ÷ 10 = .016 — .030 Min. Total
7. Over .001 Tol. — .007 Min.
   Gage every 10th pc. one position .07 ÷ 10 = .007

Micrometer O.D. & Depth: .210 Min.

Time Allowed Per Piece					
Diameter		Diameter Grind		Shoulder Grind	
Over	Thru	Less Than .005 S. R. or .001 & Over Tol.	Over .005 S. R. under .001 Tol.	.020 R. or Less	More than .020 R.
0	.250	.017	.034	.036	.018
.250	.550	.034	.068	.072	.036
.550	.850	.040	.079	.085	.043
.850	1.150	.043	.085	.090	.045
1.150	1.450	.049	.097	.102	.051
1.450	1.700	.053	.106	.112	.056
1.700	2.000	.062	.121	.128	.064
2.000	2.300	.065	.131	.138	.069
2.300	2.600	.071	.141	.150	.075
2.600	2.900	.074	.147	.157	.079
2.900	3.200	.100	.200	.211	.106
3.200	3.500	.106	.212	.225	.113
3.500	3.800	.114	.227	.240	.120
3.800	4.100	.121	.242	.257	.129
4.100	4.400	.131	.261	.277	.139
4.400	4.700	.142	.283	.300	.150
4.700	5.000	.155	.309	.327	.164
5.000	5.300	.170	.340	.360	.180
5.300	5.600	.189	.378	.400	.200
5.600	6.000	.213	.425	.450	.225

CHART NO. 4—WHEEL DRESS ALLOWANCE, automatic and hand operated grinding. Select OD being ground in column marked "Diameter" and read time value at right under "Time Allowed Per Piece." These values are noted on work sheet to right of their respective OD sizes. Time allowed for wheel touchup when grinding a shoulder is stated in column on work sheet marked "Time allowed Wheel Touchup Shoulder Grind."

Table to Machine		
Weight(lbs)	Pick Up	Aside
0 - 1	.033	.034
1.1 - 5	.040	.034
5.1 - 10	.045	.034
Skid to Machine		
Weight(lbs)	Pick Up	Aside
5.1 - 10	.059	.041
10.1 - 20	.073	.051
20.1 - 30	.093	.068

CHART NO. 5—PICK UP AND ASIDE CHART.

Surface Gage:		.120 Min.
Check piece before grind (Use only when no arbor is used)		——
Check piece after grind		.100 Min.
Flush Pin Gage:	Before	.070 Min.
	After	.070 Min.
Snap Gage (Go-No-Go)		.080 Min.

Personal and Unavoidable Delay

These allowances cover the following types of external grinders (center type):

Norton 6 x 18
Landis 4 H Plain
Brown & Sharpe No. 20
Brown & Sharpe No. 5
Brown & Sharpe No. 2
Cincinnati No. 3

This data was gathered from 8 hour studies.

Width of Shoulder	Time Per .001 Stock Removed Off Shoulder
0 - .250	.014
.251 - .375	.030
.376 - .500	.034
.501 - .625	.040
.626 - .750	.044
.751 - .875	.048
.876 -1.000	.052

CHART NO. 6—SHOULDER GRINDING TIME. When calculating grinding time for a shoulder grind, refer to part print for width of shoulder. Then refer to chart to corresponding size. Chart will give time to remove .001-inch stock off the face of the shoulder. From part print or print of preceding operation, find amount of stock to be removed. Multiply number of .001's stock by time allowed per .001 to get time to grind shoulder. EXAMPLE: A shoulder width of .500, with .008 stock to remove. .034 x 8 = .272 min.

Unavoidable Delays: Allowed 15.00 Minutes

These delays occur throughout the day and consist of:

1. Receiving instruction from setup man, foreman or inspector.
2. Trips to inspection bench or tool crib.
3. Interference from or assistance to truckers or material handlers.
4. Adding coolant to machine.
5. Clean machine and work area.
6. Fill out time card, and job card.
7. Get tools out, and put away.

Wheel Care Allowance:

The wheel care allowance is included in Chart No. 4 which is carried over to the work sheet and given a time allowance per piece.

Personal Time:

The Personal Time allowed is as follows:

1. End of shift wash up.	7.00 Minutes
2. Two coffee periods (5.00 minutes each)	10.00 Minutes
3. Personal	16.00 Minutes
	33.00 Minutes
Unavoidable Delays Allowance	15.00 Minutes
Total Personal and Unavoidable Delay Allowance	48.00 Minutes

$$\frac{48.00}{480.0 - 48.00} = 11.1\% \text{ Allowance}$$

How to Use the Work Sheet

As we've said before, the Standard Data Work Sheet is an important key to the success of any standard data program. It is the tool with which the job estimator calculates the total time for the operation and sets the production standard. To be useful to the estimator, the work sheet must be designed for convenience and ease of calculation.

To explain the use of the work sheet on this and the following pages, we've worked out a sample time for an operation. Calculation is done on the front of the sheet, using data found in charts on the back of the sheet.

It's important that all details of an operation be

continued

filled into the sheet. After the standard is calculated and transferred to shop routings and payroll records, it must often be referred to in any investigation of the standard.

When additional elements not found on the Work Sheet are found to be necessary, a time study should be taken to obtain this information. This additional element should be recorded in the writeup for future reference and development of standard data for the operation.

Before beginning the calculation of a standard, you will want to check the standards department files for any information on the part number concerned. Then get a finish print of the part. These, together with the Work Sheet, are what you'll need to determine the standard.

Steps in Completing the Work Sheet

1. Fill in upper right hand corner of Work Sheet with part number, operation number, department number, type machine, and description of operation.
2. Fill in upper left hand corner of Work Sheet with type of grind (plunge or oscillation), R.P.M. of work (refer to page 8, chart No. 2). On a plunge grind standard you do not need

Work Sheet on External Grinding Center Type (Plunge & Oscillation)

Type Grind – Oscillating Plunge ←			Part No. AB12959	Oper. No. 360	
R.P.M. of Work 500 No. of Strokes Per Min.			Part Name SHAFT	Dept. No. 738	
Feed Per Stroke HAND FEED			Type Machine NORTON		
Grinding Wheel No. Weight 2#			Description of Oper. GRIND .7805 DIA. & SHOULDER		
Dia. .7805 Tolerance .0004 Length					
Machine Handling Elements:			Piece Handling Elements:		
Pick up & Aside Piece Table to Machine (See Chart #5)	.074	.074	Pick up & Aside Piece Table to Skid	.046	.046
Position & Remove Piece from Centers	.077	.077	Position & Remove Dog	.080	.080
Start & Stop Workhead	.040	.040	Check O.D. (See Chart #6)		.078
Advance Wheel to Grind (Plunge)	.036	.036	Check Length Before (See Chart #6)		
Advance Wheel to Grind (Oscillation)	.071		Check Length After (See Chart #6)		
Position Wheel to Shoulder	.045	.045	Load & Unload Arbor		
Position Table to & from Piece	.075		Grease Centers	.045	
Retract Wheel	.030	.030			
Secure Piece in Steady Rest	.100				
Engage & Disengage Table Oscillation	.040				
Start & Stop Coolant	.043	.043			
Stone Corner	.086				
Total Machine Handling Time		.345	Total Piece Handling Time		.204
			Machine Handling Time		.345
			Piece Handling Time		.204
Plunge Type Grinding Time (See Chart #1) Time per .001 Stock .020 x No. of .001's Removed 14 = Time .280					.280
(See Chart #1) Lap Out Time .110 DONE DURING PIECE HANDLING					
(See Chart # 7) Shoulder Grinding Time .014 x 5 = .070					.070
(See Chart #1) Wheel Dress Allowance Plunge Grind of O.D.					.079
(See Chart #8) Wheel Dress Allowance Shoulder Grind					.085
Oscillating Type Time of Table Travel Min./Inch x Length x 2 (Stock Removed / Feed/Oscillation) = Time (See Chart #2) _____ x _____ x 2 (/)					
(See Chart #2) Lap Out Time Time Per In. x Length = Time _____ x _____ =					
(See Chart #1) Spot Grind Time Time Per .001 x No. .001's Removed = Time _____ x _____ =					
Clean Up of Radius or Shoulder .055					
(See Chart #4) Wheel Dress Allowance for Oscillating Grind					

Date Entered		Total Minutes Per Piece	1.063
Previous Standard Hrs. 2.243		Personal and Unavoidable 11.1 %	.118
Previous Pieces Per Hr. 44.6		Total	1.181
Date 12-2-55		20% Adjustment	.236
Computed By GEORGE PHILLIPS		Total Allowed Minutes Per Piece	1.417
Checked By		Hrs. Per 100 Pieces	2.362
Foreman Approved		Pieces Per Hr.	42.3

Oscillating Grind Chart # 2

Cu. In. / .001 / Lin. Inch	Diameter Over	Diameter Thru	R.P.M. of Work	Type I Table Travel Inches/Min.	Type I Min/Inch	Type I Lap Time	Type II Table Travel Inches/Min	Type II Min/Inch	Type II Lap Time
.0012		.750	310	388	.0026	.026	233	.0043	.043
.0014	.750	.875	242	303	.0033	.033	182	.0055	.055
.0016	.875	1.000	230	288	.0035	.035	173	.0058	.058
.0018	1.000	1.125	205	256	.0039	.039	154	.0065	.065
.0020	1.125	1.375	175	219	.0046	.046	131	.0076	.076
.0022	1.375	1.500	166	208	.0048	.048	125	.0080	.080
.0024	1.500	1.750	142	178	.0056	.056	107	.0093	.093
.0028	1.750	2.000	125	156	.0064	.064	94	.0106	.106
.0031	2.000	2.250	111	139	.0072	.072	83	.0120	.120
.0039	2.250	2.500	107	134	.0075	.075	80	.0125	.125
.0043	2.500	2.750	98	123	.0081	.081	74	.0135	.135
.0051	2.750	3.250	90	113	.0088	.088	68	.0147	.147
.0055	3.250	3.500	83	104	.0096	.096	62	.0161	.161
.0063	3.500	4.000	76	98	.0102	.102	57	.0175	.175
.0069	4.000	5.000	66	66	.0120	.120	50	.0200	.200

Plunge Grind Chart # 1

Diameter Over	Diameter Thru	Time Per .001 Stock	Lap Out Time	Wheel Dress Allow.
	.250	.012	.035	.034
.250	.550	.015	.065	.068
.550	.850	.020	.095	.079
.850	1.150	.024	.110	.085
1.150	1.450	.028	.122	.097
1.450	1.700	.031	.134	.106
1.700	2.000	.035	.146	.121
2.000	2.300	.040	.158	.131
2.300	2.600	.044	.170	.141
2.600	2.900	.048	.182	.147
2.900	3.200	.052	.194	.200
3.200	3.500	.056	.206	.212
3.500	3.800	.060	.218	.227
3.800	4.100	.064	.230	.242
4.100	4.400	.068	.242	.261
4.400	4.700	.072	.254	.283
4.700	5.000	.076	.266	.309
5.000	5.300	.080	.278	.340
5.300	5.600	.084	.290	.378
5.600	6.000	.088	.302	.425

Recommended Feed Per Oscillation Chart # 3

Feed Per Oscillation			
Diameter	0 - .875	.876 - 2.000	2.001 - 5.000
Type I	.0008	.001	.0012
Type II	.0006	.0008	.001

Wheel Dress Allowance for Oscillating Grind Chart # 4

Cu. In. Stock Removed Over	Cu. In. Stock Removed Thru	Pieces Per Dress	Allowance Per Piece	Cu. In. Stock Removed Over	Cu. In. Stock Removed Thru	Pieces Per Dress	Allowance Per Piece
	.025	50	.068	.250	.275	14	.243
.025	.050	43	.079	.275	.300	13	.262
.050	.075	37	.091	.300	.350	12	.283
.075	.100	32	.106	.350	.375	11	.309
.100	.125	27	.126	.375	.425	10	.340
.125	.150	24	.142	.425	.475	9	.378
.150	.175	21	.162	.475	.550	8	.425
.175	.200	19	.179	.550	.700	7	.486
.200	.225	17	.200	.700	.900	6	.567
.225	.250	16	.213	.900	1.000	5	.680

Chart # 5
Pick Up Piece Table to Skid

Weight	Pick Up	Aside
0 - 1#	.033	.034
1.1# - 5#	.040	.034
5.1# - 10#	.045	.034

Surface Gage	
Before .120	.04 each additional position
After .100	.04 each additional position
Flush Pin Ga.	
Before & After	.140

Gaging Time Chart #6
Sheffield Gage

Length Solid	Under .0005 Tolerance
0 to 2"	.078
2" & Over	.066
Thin Wall	
0 to 2"	.086
2" & Over	.118
.0005 to .001	
0 to 2"	.019
2"& Over	.030
.001 & Over	
All	.008

Shoulder Grinding Time Chart # 7

Width of Shoulder							
0 - .250	.251 - .375	.376 - .500	.501 - .625	.626 - .750	.751 - .875	.876 -1.000	
.014	.030	.034	.040	.044	.048	.052	

Time Per .001 Stock Removed

Wheel Touch Up Allowance for Shoulder Grind Chart # 8

Diameter	.250	.550	.850	1.150	1.450	1.700	2.000	2.300	2.600	2.900
Allowance	.036	.072	.085	.090	.102	.112	.128	.138	.150	.157
Diameter	3.200	3.500	3.800	4.100	4.400	4.700	5.000	5.300	5.600	6.000
Allowance	.211	.225	.240	.257	.277	.300	.327	.360	.400	.450

No. of Table Strokes Per Min., or Feed Per Stroke. Obtain the weight of piece, and if using an arbor also add weight of arbor to piece. Fill in diameter, and tolerance.

3. Fill in elements pertaining to "Machine Handling Time."
   a. To find value for "Pick Up and Aside Piece", see reverse side of work sheet and refer to Chart No. 5, select value to correspond with weight, and enter in total column.
   b. Enter value of "Position and Remove Piece from Centers" in total column.
   c. Enter value of "Start and Stop Workhead" in column when piece is run on hand operated machine, on automatic machines the workhead starts and stops during the advance and retract of the wheel.
   d. Enter value for "Advance Wheel to Grind."
   e. Enter value for "Retract Wheel."
   f. Enter value for "Position Wheel to Shoulder" only when grinding a shoulder or when the width of an undercut is .125" wide or less.
   g. Enter value for "Position Table to and from Piece" when table must be cleared to remove piece and to position piece in centers.
   h. Enter value for "Secure Piece in Steady Rest" when routing calls for a steady rest.
   i. Enter value for "Stone Corner" when routing calls for Stone Corner.
   j. Enter value for "Start and Stop Coolant" when using hand operated machine, on automatic machines the coolant starts and stops with the advance and retract of the wheel.

   Total all elements in column and enter the total time in column at right titled "Machine Handling Time."

4. Fill in elements pertaining to "Piece Handling Time."

continued

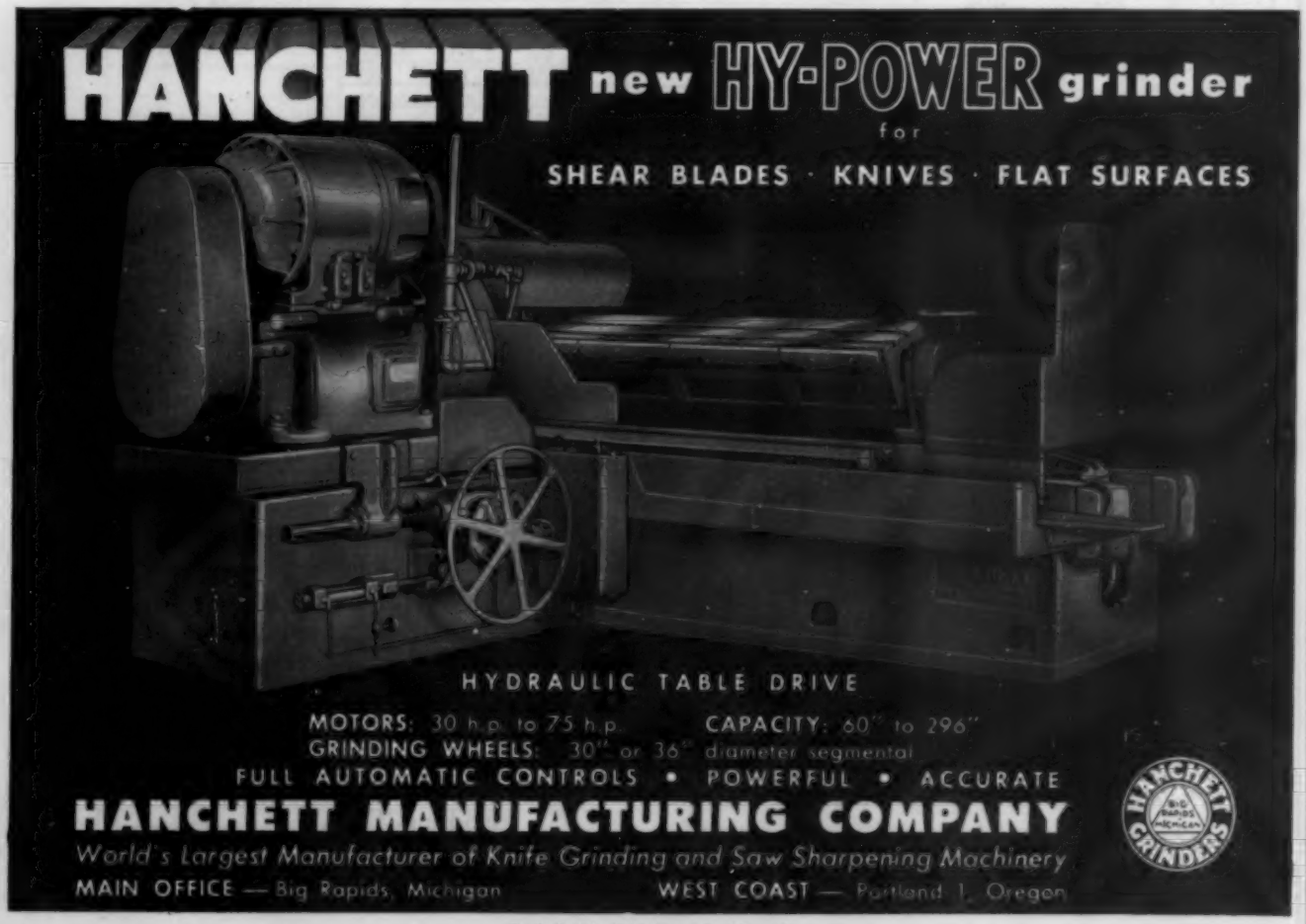
a. Enter value for "Pick up and Aside piece from Table to Skid" in total column.
b. Enter value for "Position & Remove Dog," only when using dogs, not while using an arbor; arbors have stationary dog at driving end.
c. From Chart No. 6 select the proper "Check O.D." value determined by length of grind and tolerances being held. Enter the value in the total column.
d. When B.L. or blueprint calls for a specific length to be held and centers are used, refer to Chart No. 6 and select value for "Surface Gage Before Grinding." When face of shoulder is greater than ½" allow two additional positions. Total the values and enter in the total column. Values do not apply when an arbor is used.
e. Paragraph "d" applies to "Surface Gage After Grinding," and is allowed when either arbors or centers are used.
f. When an arbor is to be used and "Piece Handling Time" will be external, a time study check must be made for this element to derive the time allowance. Plot this time on Spread Sheet for future data.
g. When "Greasing of Centers" is required, allow the value shown for an established frequency, i.e., 1/1, 1/2, 1/3, etc.

Total all elements in column and enter the total time in column at right titled "Piece Handling Time."

Note: When this total time is exceeded by the "Lap Out Time," it is to be circled out. Elements will be performed internal to the "Lap Out Time."

Calculation of Grinding Times

5. Plunge Grind:
   a. Upon determining diameter to be ground, refer to Chart No. 1 on reverse side of work sheet and circle the time values shown in the columns opposite the diameter ground. Enter the "Time Per .001 Stock Removal" in space provided. Determine the total number of .001's stock removal from B.L. or blueprint, plus the T.I.R. allowed on previous operation and enter in the space provided as a whole number, e.g., (.013" stock removal = 13). Multiply and enter in the total column.


HANCHETT new HY-POWER grinder
for
SHEAR BLADES · KNIVES · FLAT SURFACES
HYDRAULIC TABLE DRIVE
MOTORS: 30 h.p. to 75 h.p.
CAPACITY: 60" to 296"
GRINDING WHEELS: 30" or 36" diameter segmental
FULL AUTOMATIC CONTROLS • POWERFUL • ACCURATE
HANCHETT MANUFACTURING COMPANY
World's Largest Manufacturer of Knife Grinding and Saw Sharpening Machinery
MAIN OFFICE — Big Rapids, Michigan
WEST COAST — Portland 1, Oregon
HANCHETT GRINDERS
BIG RAPIDS MICHIGAN

b. From Chart No. 1 select the proper "Lap Out Time" and enter in the total column **only** if this time exceeds the "Piece Handling Time".

c. From Chart No. 7, select the proper "Shoulder Grind Time", determined by the width of shoulder, and enter in the space provided. Determine the total number of .001's stock removal from the face of shoulder from the B.L. or blueprint, plus the T.I.R. allowed on previous operation and enter in the space provided as a whole number, e.g., (.005″ stock removal = 5). Multiply out the same as grind time and enter in the total column.

d. From Chart No. 1 select the proper "Wheel Dress Allowance" for the plunge grind of the O.D. and enter in the total column.

Note: When holding a micro finish of 15 or less and/or grinding an interrupted surface with a tolerance of .0005″ or less, double the allowed time.

e. From Chart No. 8 select the proper "Wheel Dress Allowance for Shoulder Grind", determined by the diameter being ground and enter in the total column.

Note: Allowance is to be used when an undercut is shown between O.D. and shoulder or when a radius of .020″ or more is ground. When holding a radius less than .020″, double the allowed time.

6. Add right hand column and enter total on "Total Minutes Per Piece" line.
7. Multiply item 7 by 11% and enter result on "Personal and Unavoidable" line.
8. Add items 7 and 8 and enter total on "Total" line.
9. Multiply item 9 by 20% and enter result on "20% Adjustment" line.
10. Add items 9 and 10 and enter total on "Total Allowed Minutes Per Piece" line.
11. Divide above total by .6 and enter result on "Hrs. Per 100 Pieces" line.
12. Divide the number 100 by item 14 and enter result on "Pieces Per Hr." line.
13. Fill in lower left hand corner of work sheet, items, "Previous Standard Hours", "Previous Pieces Per Hour", "Date" and "Computed By".
14. Have standard checked by department supervisor and signed by the department foreman.
15. Make out change slip and stamp standard with "Date Entered."
16. File standard for future reference.

End of Part 2. Next month in part 3, oscillating center-type grinding will be covered. Subsequent parts will give data for centerless and center lapping operations.

ACCURACY .0002 T.I.R.

.0002 T.I.R. OR LESS AT SPINDLE NOSE, .0005 T.I.R. OR LESS ON TEST ARBOR SIX INCHES FROM SPINDLE NOSE

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost. Same Accuracy Guaranteed!

The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B&S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

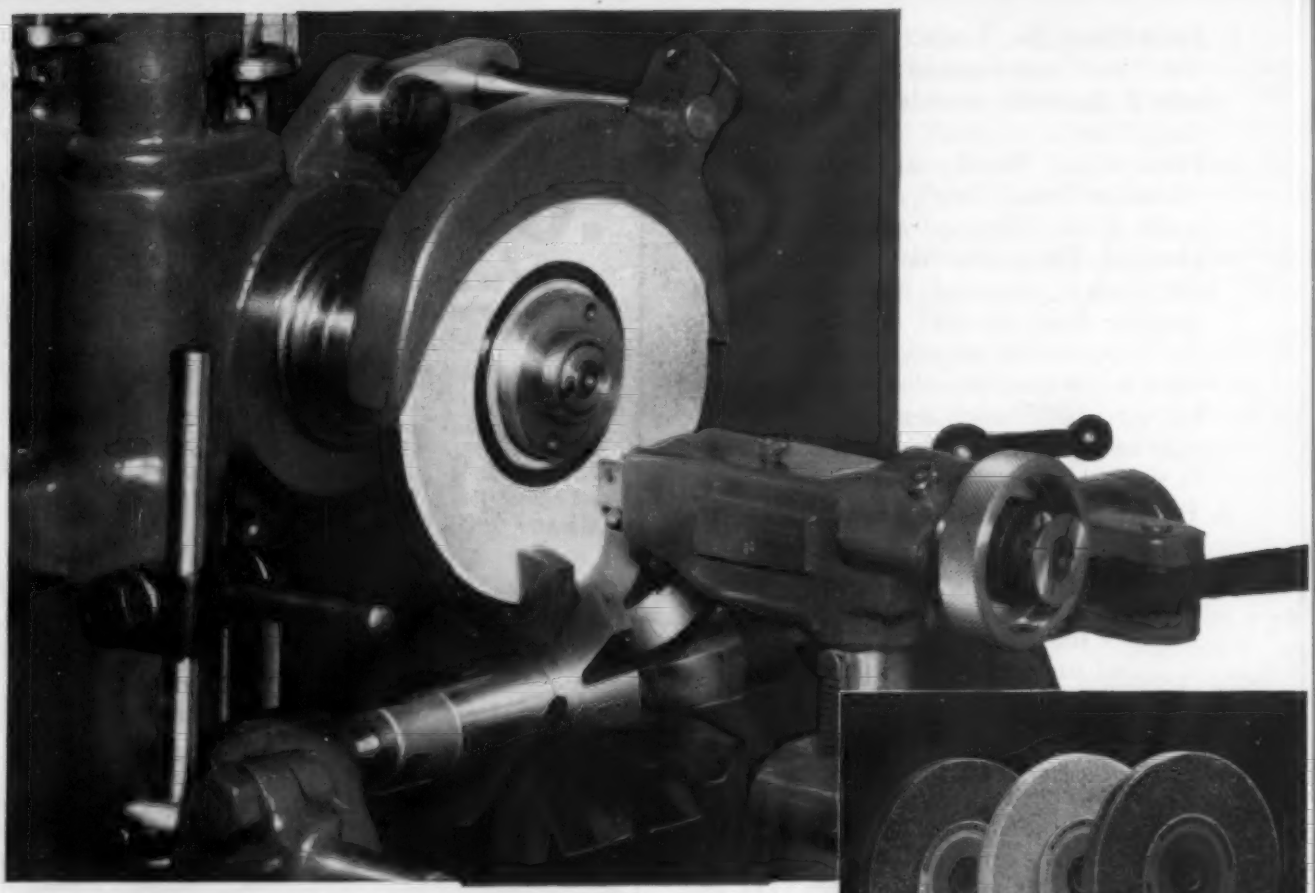
The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

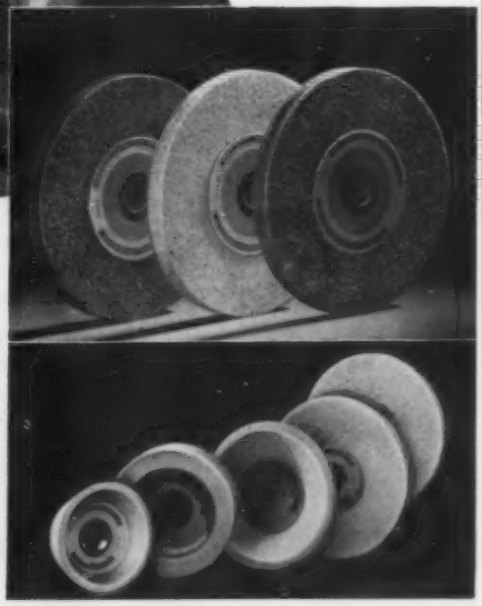
K. O. LEE COMPANY

ABERDEEN, SOUTH DAKOTA

Encircle No. 216 on postpaid card



Sharpening formed cutter with Macklin V-6 Wheel



You can spark *your* production on every tool room grinding job with Macklin "Wheels of Profit". They stay sharp longer, cut faster and cooler. These precision performers include:

V-6 Wheels . . .
used principally to grind alloy steels of high tensile strength.

V-5 Wheels . . .
(silicon carbide). The popular choice to *economically* grind non-metallic, non-ferrous, and other materials of low tensile strength.

VMM Wheels . . .
(aluminous oxide or silicon carbide). The revolutionary new type wheel rated tops for precision grinding and finer finish.

FOR PROOF OF PERFORMANCE . . . READ THIS!

Operation . . . Surface grinding ends of carbide inserts in automotive plant.

		Here are the figures:	*WHEEL LIFE*
Production	**Wheel Cost**	Macklin 1" Wheel . .	60 hours
—Up 187%	—Down 50%	Competitors 1½" Wheel	32 hours

Macklin wheel was faster cutting, required no dressing, and user states, "It was possible to eliminate several diamond operations."

TRY MACKLIN WHEELS ON *YOUR* NEXT JOB . . .
A trial will convince you.

Your Macklin distributor offers a fast, off-shelf delivery. Look for him in the yellow pages of your phone book. AND TO SAVE TIME, WHEELS AND DOLLARS . . . arrange today for a trial demonstration with a Macklin Sales Engineer or your nearest distributor. No obligation, of course.

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Significance and Measurement of

Surface Finish

Part 3—Conclusion

The Interference Method
Roundness Measurement
Best Use of Reference Standards

by **R. E. Reason,** Director of Research
Taylor, Taylor and Hobson Ltd.
Leicester, England

● In this part we leave the stylus method and pass on to the interference method, which is very valuable because it can resolve scratches down to a width of about .00002″ or .00003″, provided that a high aperture microscope objective is used. Actually a stylus can be made sharp enough to approach this region, but it is rather a laboratory tool, and not suitable for general use.

The Interference Method

Figure 20 (a) shows the principle of the interference method, well known in the form of 'Newton's rings'.

An optical flat O is placed over the surface Z to be tested, so that a beam of light falling on the two is reflected partly by the optical flat and partly by the surface under test, which must itself be reasonably reflective. The beam returning from the surface under test lags behind the beam from the optical flat because it has had further to go. Remembering that a beam of light is in effect a very high frequency vibration, it will be seen that if the lag is such that the beams re-combine 'in phase' the brightnesses will add and the eye will see a bright area; but if the beams combine out of phase the brightnesses will subtract and the eye will see a dark area. We may imagine that the optical flat carries parallel to it a number of section planes

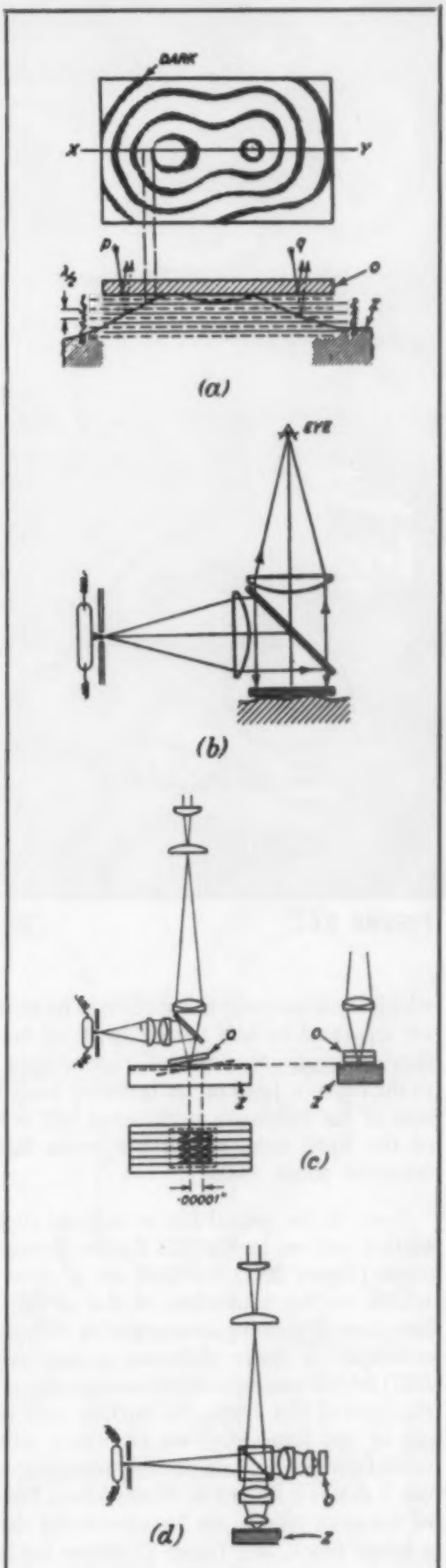

FIGURE 20

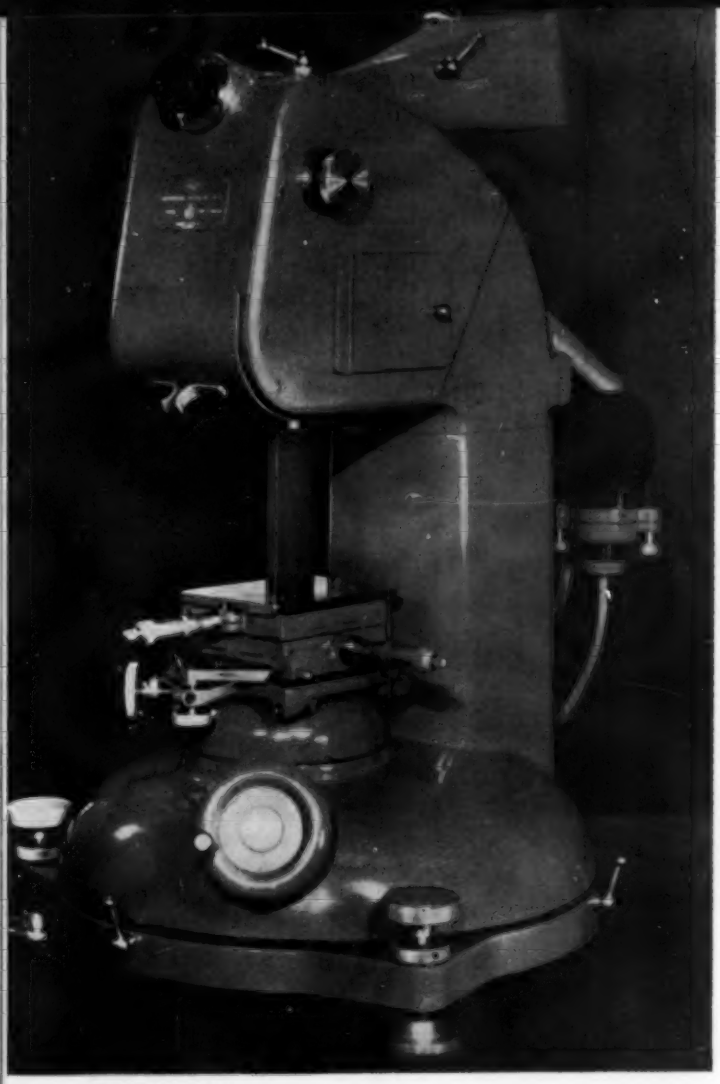

FIGURE 21

which will intersect the surface to be tested. If these are separated by half a wavelength of the light used they will trace out a series of contour lines, equivalent to the contour lines on an ordinary map, the separation of the successive steps being half a wavelength of the light used, which for green light, can be taken as about ·00001″.

Now, if the optical flat is inclined slightly to the surface and we look at the texture through a microscope (figure 20C) we shall see a series of fringes which are the equivalent of the profile graphs we have been discussing in connection with the stylus instrument. A more elaborate arrangement (figure 20D) which uses two objectives conveniently removes the optical flat from the surface and permits the use of the large aperture objectives which are essential for the highest possible resolving power. Figure 2 shows a Hilger & Watts Micro-Interferometer of the same type in use for examining the surface of a gauge block, and figure 22 shows the interference fringes obtained. You see how the successive interference fringes trace out the profile of the irregularities. The picture is self-calibrating because the separation of these fringes always represents a change in level of .00001″. Therefore a valley in the profile equal to the spacing of the fringes represents a scratch .00001″ deep.

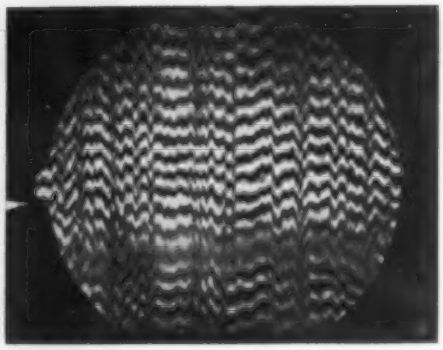

FIGURE 22

Comparing Interference and Stylus Results

The next illustration, figure 23, shows a comparison between an interference fringe and the graph obtained with a Talysurf. I must say here, and emphasize, that the horizontal magnification is 10 times the normal Talysurf value, so that we are able to see the crests spaced more closely together than ever we see in the normal instrument. The horizontal magnification is 2,000 times instead of 200, and the stylus was specially chosen with a tip dimension of not more than .00003″, so that it could cope with the very narrow scratches.

We had to take extraordinary care to select identically the same part of the surface for the interference picture and for the Talysurf. You will see there is a general similarity betwen the profiles obtained by the two methods. The major crests, which are all that would be seen on an ordinary graph, correspond quite closely with the shape of the interference fringes. The smaller intervening irregularities would not be seen on the graph at all, for the horizontal magnification is chosen efficiently to accord with the resolving power of the stylus. The fringes are rather fuzzy; they were taken some years ago. Modern interference instruments will give fringes with appreciably sharper edges.

Prof. Tolansky has worked on a multiple beam method in which instead of using a single reflection from the surface under test the mean is allowed to reflect backwards and forwards between the two surfaces, up to perhaps 50 times. This has the effect of narrowing and sharpening the dark bands until they become almost as clear and narrow as the stylus trace itself—a very beautiful technique. Unfortunately, the resolving power is lower than that of the single reflection instrument, and is, in fact, not much better than that of the ordinary commercial stylus.

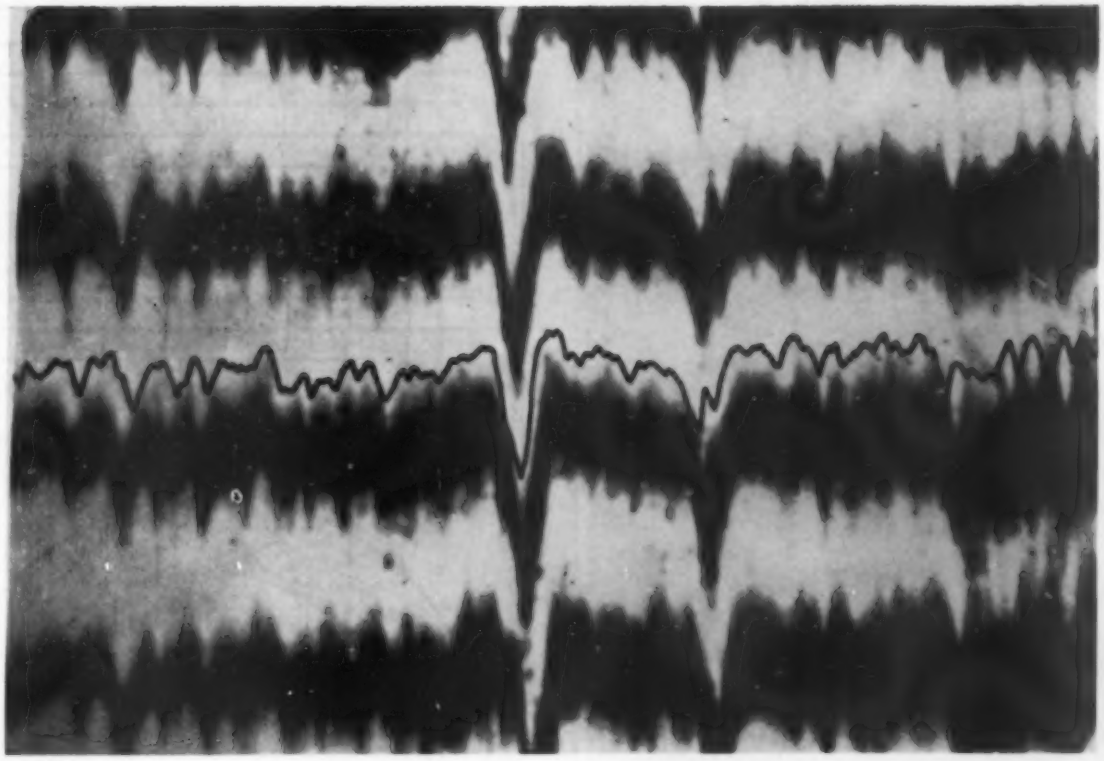

FIGURE 23

Comparing V-Block and Stylus Methods of Measuring Roundness

In Part 1 of this article, figure 7 showed two different types of stylus for measuring a flat surface in two directions at right angles. When corresponding measurements are taken on a cylindrical surface, one of the directions becomes circumferential, and we find ourselves measuring roundness.

The most convenient method of measuring roundness, the most well known, is to mount the part in a vee block and rotate it under an indicator. It is sometimes not realized that it is very important that the angle of the vee should be related to the number of lobes on the specimen, otherwise important features may be missed. Looking at figure 24, if crests and valleys simultaneously engage the tip of the indicator and the anvil or the surfaces of the vee (a, b, c) there will be a movement of the indicator equal to twice the height of the undulations, because not only will the indicator be moved up and down by the undulations but the whole part will rise and fall in the vee block. But if the angle is such that when a valley engages the tip of the indicator, the part rests on a crest or crests, and vice-versa (d, e) then the up and down movement of the piece in the vee block will cancel the up and down movement of the surface under the tip, and there will be no representation. If the undulations are uniform in height and spacing, excellent results can be obtained with this method, provided that the angle of the vee block is correctly chosen. But if the irregularities are not evenly spaced round the circumference it is difficult to decide what is the proper angle and difficult to interpret the results: one can only say that the irregularities are

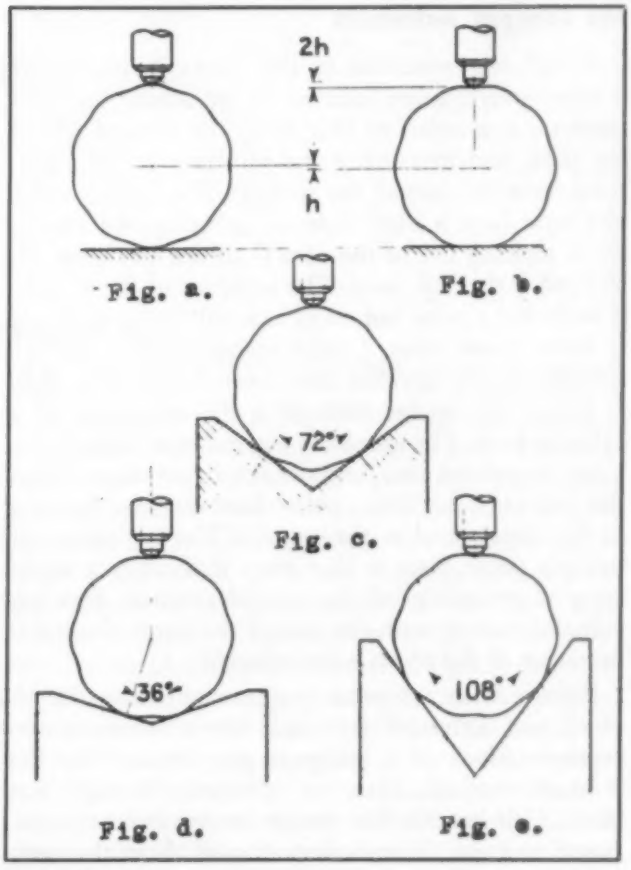

FIGURE 24

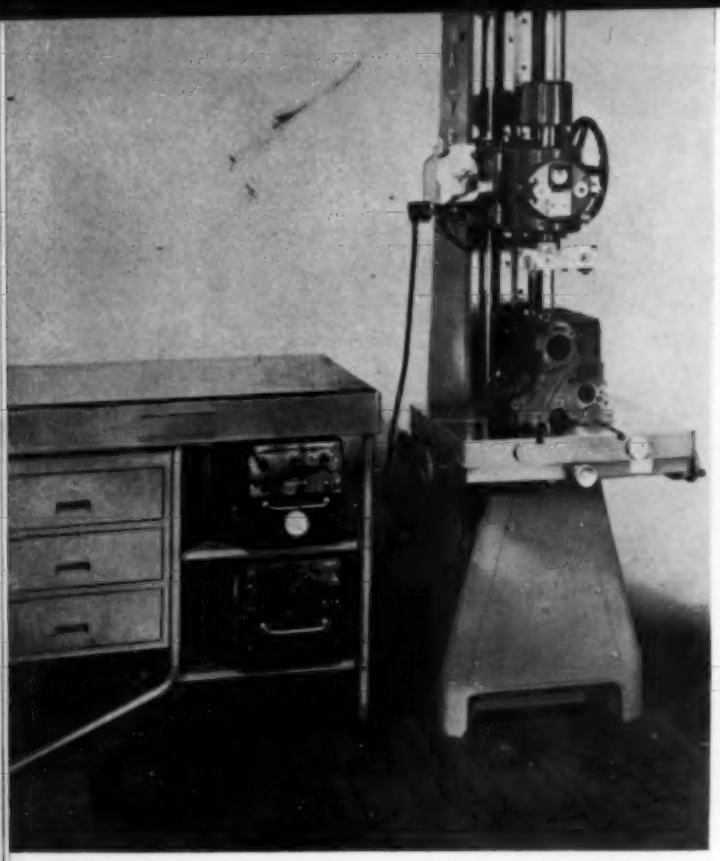

FIGURE 25

probably not more than a certain order of magnitude.

The Talyrond Instrument

A full representation of the errors in roundness is most conveniently secured by mounting an indicator on a spindle, so that it can be rotated round the part, and measuring the resulting radial variations from the axis of the spindle. The spindle must of course have a high order of accuracy. An instrument making use of the idea is shown in figure 25. We call it the Talyrond. The accuracy of the spindle is such that a point not on its axis will move so that it is never more than 2 microinches from a perfect spindle—many spindles have been better than this. It is here set up for measuring the roundness of a cylinder bore. The spindle is rotated so that the feeler traces round the bore, and the amplified output from the pick-up is fed into a polar chart recorder rotating at the same speed as the spindle. The advantage of using a polar chart is that even if there is a slight error of centering—if the axis of rotation does not coincide exactly with the axis of the bore—the interpretation of the result is not affected.

Figure 26 shows some graphs comparing the V-block and Talyrond methods. Above, we have two representations of a gudgeon pin obtained by the V-block method. First an optimum V-angle was used. This reveals five major crests, and superimposed on these, 26 secondary ones of about the same amplitude. Then the angle of the vee block was

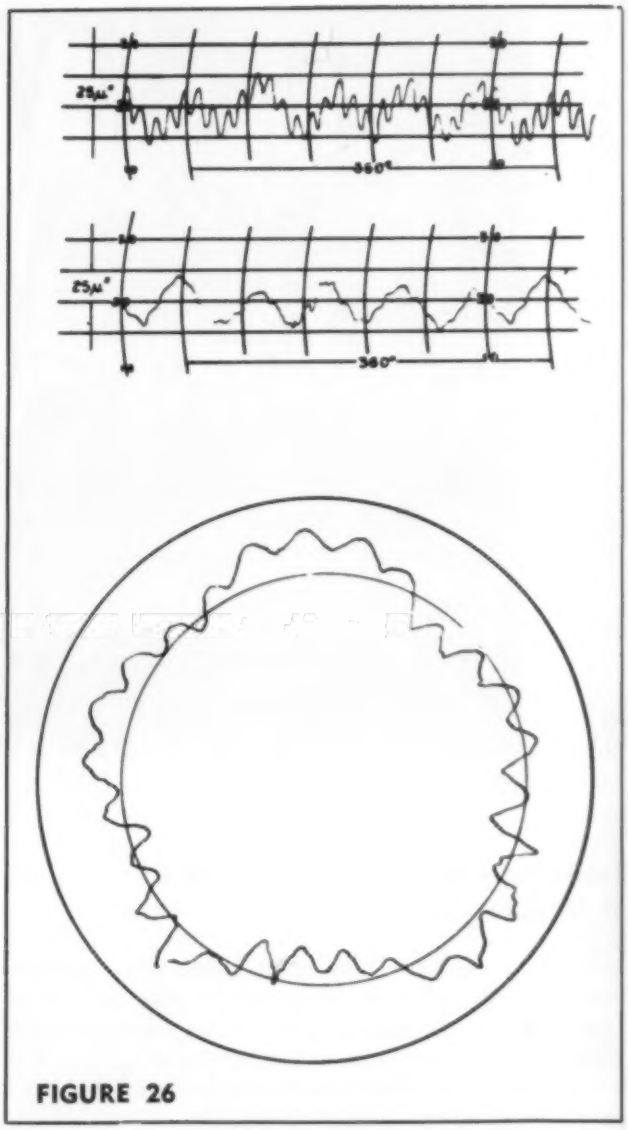

FIGURE 26

changed by 14°, the angle of the secondary irregularities. We now see no trace of secondary irregularities. So you see how important it is to have the correct angle for a vee block! Below is a polar representation obtained by the Talyrond, showing clearly the five major crests and the 26 secondary ones.

Polar Graphs Made With Talyrond

Figure 27 shows some interesting polar graphs of various components obtained with the Talyrond instrument. Top left shows the graph of the track of a ball race; you see a number of pronounced lobes and some minor ones. Top right shows the polished track of a ball race, bottom left the shape of a roller. The undulations look dreadful but you must understand that the radial magnification is very considerable—10,000 times, so that the actual magnitude of these lobes is only about half a ten-thousandth. Bottom right shows a check on concentricity—outside and inside of a race graphed without change in centering. Lobes out of place may be counted.

These polar diagrams have a very convenient prop-

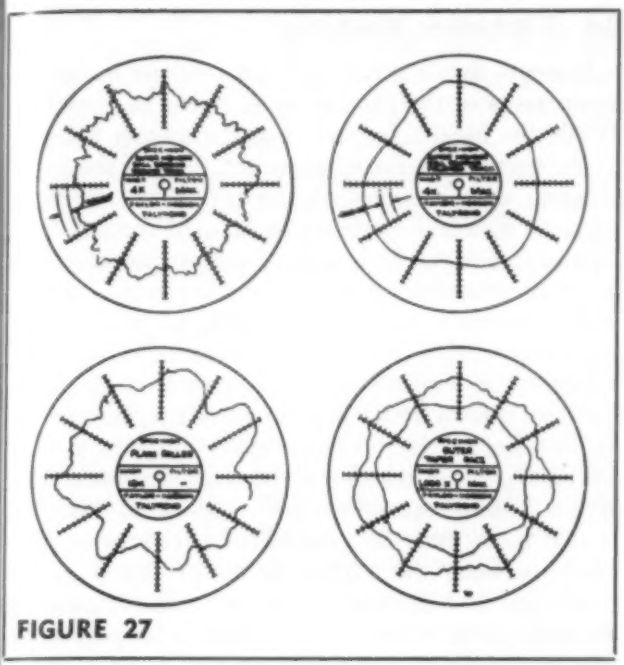

FIGURE 27

erty—that opposite points on the part are always opposite through the hole in the paper, and this makes it very easy to decide, by successive diametral measurements, whether the part is one which, although not round, has a constant diameter. Most of these parts are of this kind, especially the roller. It doesn't have a constant radius but it has a constant diameter, and for the purpose of rolling in a roller race it is probably perfectly acceptable, except perhaps at high speeds.

Figure 28 shows some more results that were obtained. Top left and right are traces of balls each examined in three different meridians; the latter shows one round and two three-lobed traces which is a common finding. Bottom left shows a rather interesting case. This was the track of an inner ball race. It had been ground on a new machine, and you will see that the machine broke into vibration periodically, producing a track that was much worse on one side than the other. Immediately the manufacturer of the race saw the graph he went off to look for the cause of the trouble, which he found. He did not realize it was there until he had the graph to tell him; but that of course is what one finds over and over again—the value of these instruments is not solely to test the product all the time, it is to help in finding out what are the basic defects in the machines that make it and so pave the way to curing them.

Bottom right are two traces of a part recorded at slightly different radii to show that the instrument is capable of repeating itself.

Interpreting the Polar Graphs

Before leaving these graphs there is another point about their interpretation I should like to make. The star-shaped graphs often seen do not mean that the

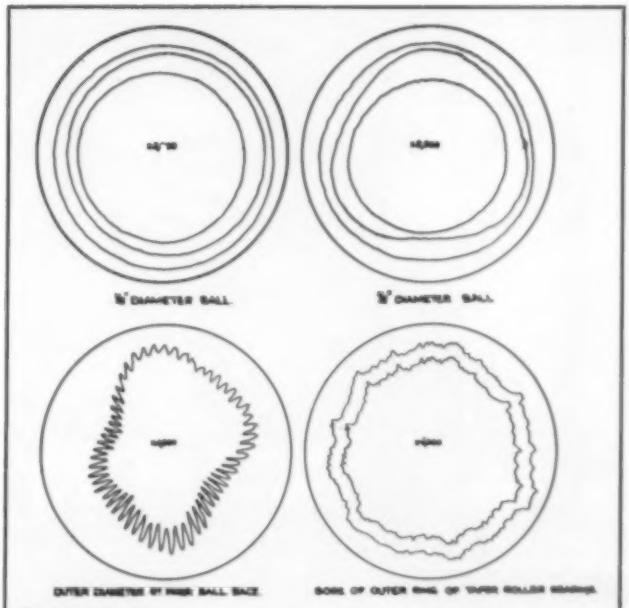

FIGURE 28

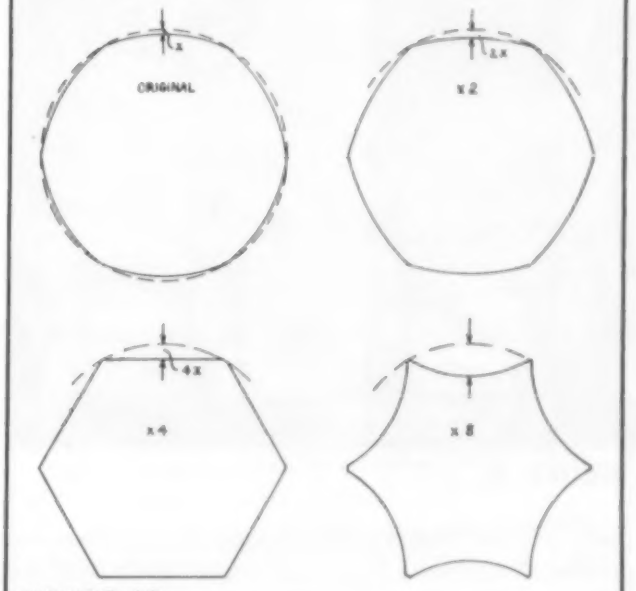

FIGURE 29

parts are really shaped like Walt Disney cartwheels. They come about because these graphs are not graphs of the actual shape of the whole part; they are graphs of the departures from true shape, plotted to a very large scale of radial magnification, round a circle which is not scaled up in the same proportion. In figure 29 the dotted line is a true circle. Inside this circle is a figure which represents a part slightly flatted in six places by an amount 'X'. In the succeeding parts of the figure, the departures from roundness are scaled up without increasing the actual diameter of the picture. If we scale up by a factor of 2, we can see the "flatting" more clearly than in the original. To see it yet more clearly, we multiply all the radial departures by 4: the result is almost a regular hexagon! We go a step further and multiply by 8, and

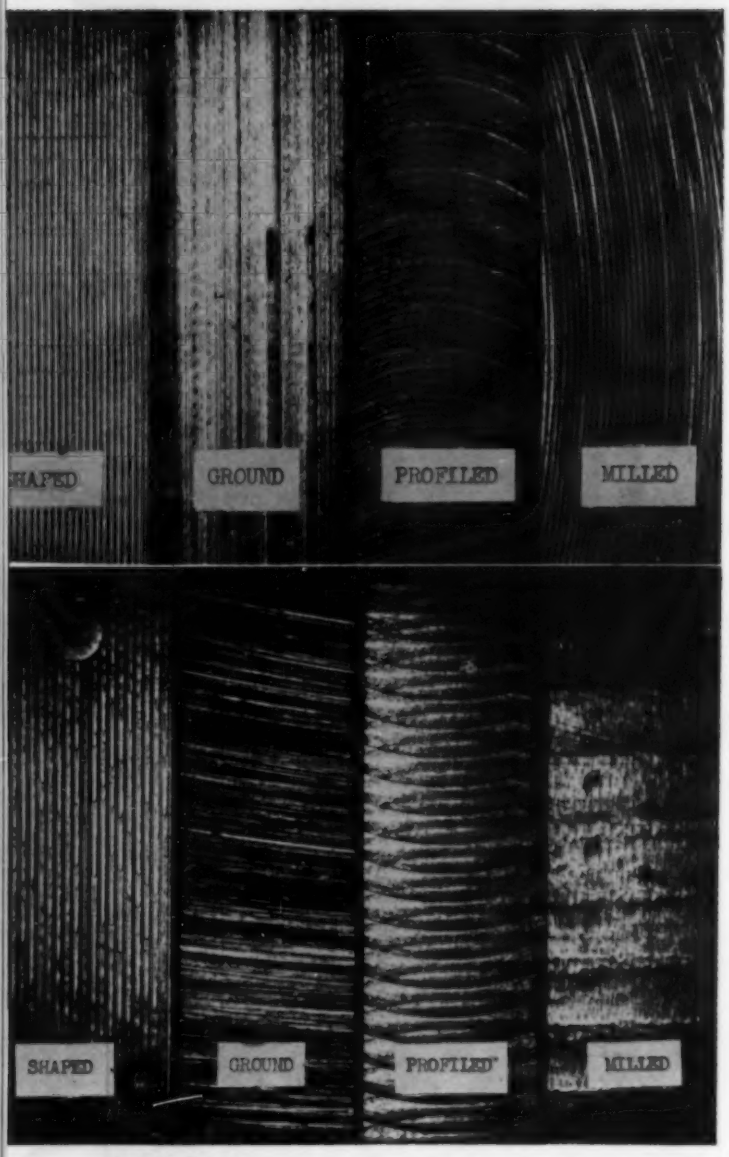

FIGURE 30

now get the familiar star shaped figure. You will realize that all these figures are representations of the errors of the self-same part; so we must, when we look at these diagrams, take vividly into account the magnification and think back to the proportions of the actual part to see what the graph really means.

Practical Shop Pointers

I should like to end, as it were, in the workshop. We in Leicester believe, in common with many others,that if surface finish values are to be put on drawings, the machine operator should be given the means for deciding for himself whether or not he is working to drawing, before he turns his work in to an inspector equipped with measuring instruments. We think the psychology of asking the operator to work blind when the inspector is armed to the teeth is all wrong, but it is a problem not easily solved because of the unavoidable expense of many of the instruments we have been discussing.

Use of Reference Standards

It seems that a great deal can be done by simple comparison of the product with a reference surface. While the ideal reference is an acceptable example of the part itself—for example the first off the batch checked with a master instrument—there are times when a 'standard' surface can be used instead. This idea has been widely developed and one can now buy boxes of reference surfaces, milled, ground, turned, and so on, each in different grades of finish. Comparison is made by touch (which can be surprisingly effective) or with a manually operated stylus instrument such as the Profilometer or Surfagage in America. But there are certain conditions which need to be fulfilled if the method is to be effective—conditions which I think are sometimes overlooked. The first is that there must be a considerable degree of similarity between the surface being produced in the workshop and the surface given to the operator as an example of what he is supposed to be producing. Figure 30 may be effective in bring this out. It shows specimens in the 500 microinch group taken from two different American sets. We see in each set a surface labelled for example "milled" with a CLA index of 500; but in one set the surface has been roller milled while in the other it has been end milled. If the operator is working with a roller mill it is absolutely useless to give him a sample of end milling—despite the fact that it has been milled, and despite the fact that it has the requisite value. The sample must approximate the product, not only in general type, but also, in the case of cut (as distinct from abraded) surfaces, in traverse feed. For a given height value, a change in traverse feed can greatly deceive the finger. At least in the case of the coarser specimens, the finger always prefers the specimens with the more widely spaced crests, apparently because it is sensitive not only to height, but also to the slope of the flanks.

Standards Should Be Labeled

It has always seemed to me that a box of standard specimens should have with it a statement—an **exact** statement—of the details of the process by which each surface has been produced. In the case of grinding this is not easy, because so much depends on the condition of the truing tool. One solution is perhaps to specify all the quantities which can be specified—the grit, bond, traverse speed, depth of cut, and so on, and then say that with all these quantities under control, the wheel should be trued with a diamond (or other specified tool) so as to produce the desired figure. Actually, the most enormous variations can be produced by variations in truing. In England, Rolls Royce once produced for their own use a set of ground surfaces running from 4 to 125, all ground with the same wheel and used and trued in different ways, just to show the operator what effect these aspects alone could have.

There are other considerations too—wavelength cutoff and tip radius—that can only affect work and specimen equally, and properly cancel out, provided that the requirement of adequate similarity, especially of crest spacing, has been satisfied.

The question of wavelength cut-off, manifesting itself in the case of hand operated instruments as sensitiveness to speed of traverse (more so on some specimens than others) has already been discussed.

Effect of Tip Radius

Regarding stylus tip radius, we took a number of surfaces and measured them with three pick-ups having different tip radii, first .0001 inch, which gives about as true a picture as can be had, then .001 radius, and finally .0025 radius, this value being found in certain continental instruments.

Results are shown in Figures 31 and 32. For the first specimen, produced by turning and put out by one maker as a standard for instrument calibration, the reading with the blunt stylus is actually greater than with the sharp one. The reason for this is that while there is a small loss in the valleys there is a thickening of the crests (this always happens) which in this case more than offsets the loss in the valleys. For specimens 2 and 3, ruled in the stylus of the General Motors Caliblock, the blunt stylus leads to a loss as might be expected. For specimens 4 and 5, which are respectively the fine and coarse NPL-type etched glass standards provided with the Talysurf, there is a substantial loss for the **coarse** one, but no significant loss for the **fine** one. The reason for this is that while the line widths are about the same, the depths differ, and it happens that the blunt stylus will bottom the shallow but will not the deeper groove. In the case of specimen 6, produced by turning, the blunt stylus leads to a slight though hardly significant loss. In the case of the ground surfaces 7, 8, and 9, the loss, interestingly, is greatest for the roughest surface.

I think you will see how important is the question of adequate similarity of specimen and product if the best is to be gotten out of simple comparison methods. I believe the practical answer is to have a master graphing instrument to make the initial comparison, and then a number of simpler instruments to take over in the workshop.

To conclude, through the efforts of an ever-growing number of investigators, great progress is being made in our understanding of the measurement and significance of surface finish. There is only one royal road, the slow road of patient exploration, checking all proposals in the experimental shops before rushing them onto drawings. Indeed I would still say that ideally no one should put a surface finish index on a drawing unless he can say what would happen if the suggested figure were doubled. This is counsel of perfection; but it is perhaps worth a passing thought. ● ● ●

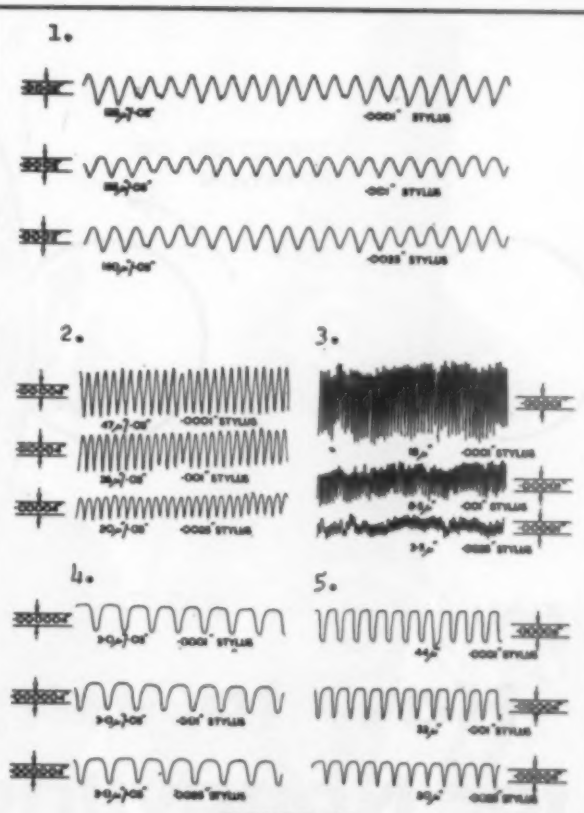

FIGURE 31

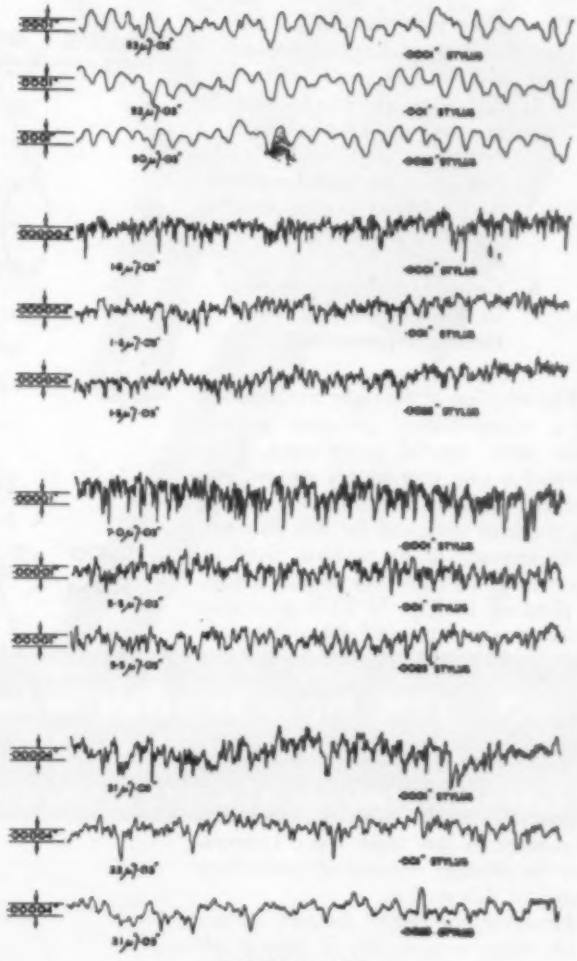

FIGURE 32

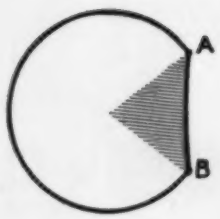

FIG. 1

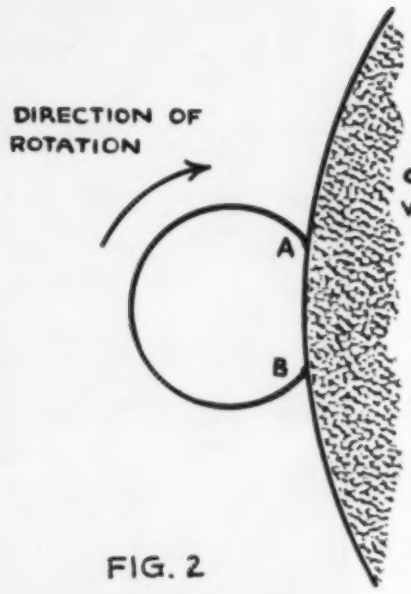

FIG. 2

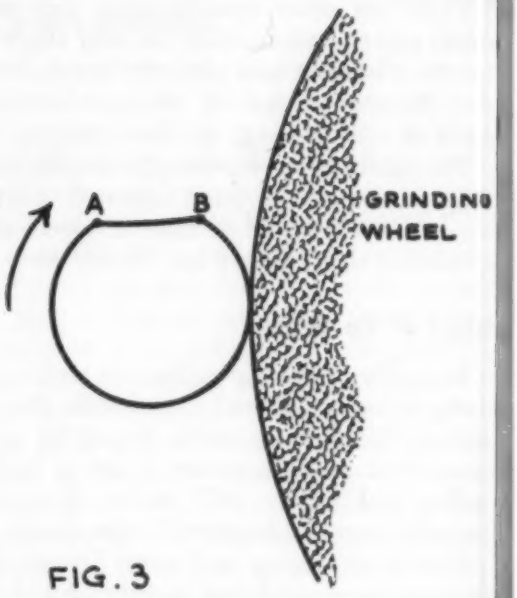

FIG. 3

How to Vary Work Speed for Noncylindrical Grinding

Try using two clutches with two distinct pulley systems. The advantages are:

1. **Drive motor always turns at the same speed.**
2. **No need to accelerate or decelerate motor armature during speed changes.**
3. **Grinding time was cut in half for this particular operation.**

The selection of the right work speeds for a noncylindrical grinding process poses some special problems. This method is one way to get around the problem without investing in a grinding machine designed for this purpose.

An example is the problem faced in regrinding the cam lobe whose section is pictured in Fig. 1. This particular shape was encountered when regrinding the injection cam lobe from a Cummins truck engine camshaft. The surface of the lobe from point A to point B is a slightly involute shape. When the grinding wheel is contacting this area, Fig. 2, the grinding action is poor due to the relatively large area of contact. A low work speed is necessary for efficient removal of stock when grinding this section.

However, the rest of the cam surface apart from section AB is nearly cylindrical. When the grinding wheel is touching this almost cylindrical section

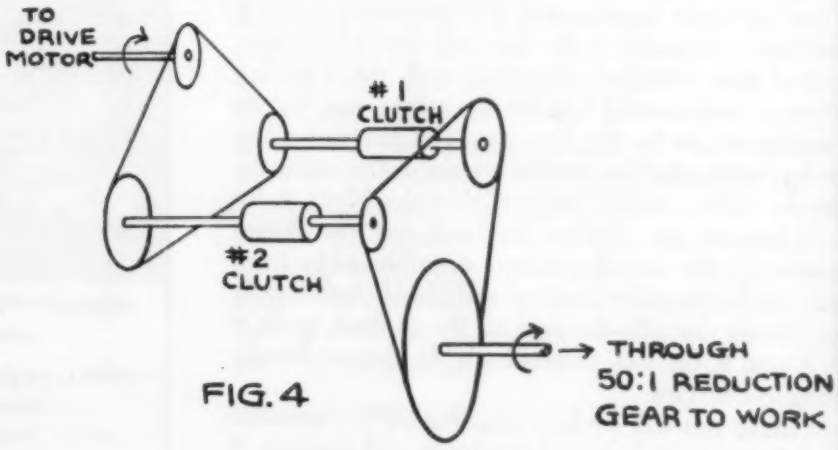

FIG. 4

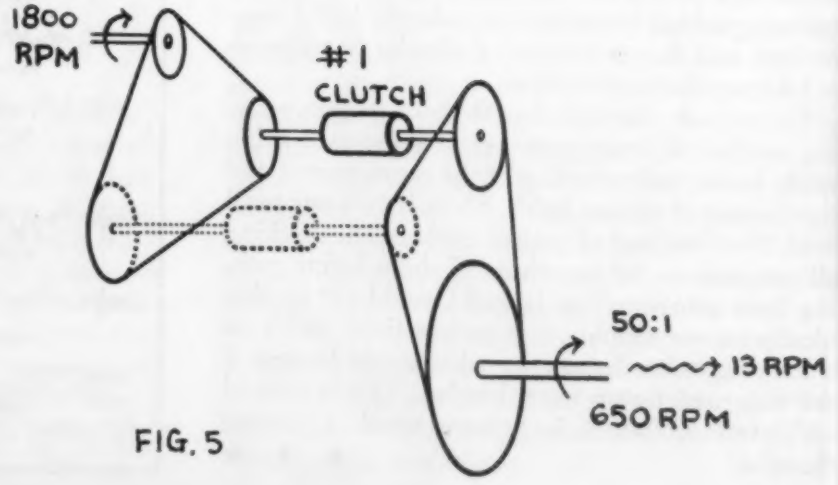

FIG. 5

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Chicago Wheels are available in all standard sizes and over 200 special shapes. This wide selection of these tough, fast cutting Chicago Mounted Wheels makes it possible for you to choose just exactly the right mounted wheel for your job. And delivery of most Chicago Mounted Wheels is prompt . . . right out of stock.

TRY CHICAGO MOUNTED WHEELS TODAY

Let us send you two samples of these true-running uniform Chicago Mounted Wheels. Try them at no cost to you. Send coupon below.

WHEN YOU THINK OF MOUNTED WHEELS SPECIFY . . . CHICAGO!

CHICAGO MOUNTED WHEELS are manufactured under positive density control to insure peak job performance.

GUARANTEED to stay on their mandrels, they are perfectly balanced, easily dressed, and hold their shape.

SAVE TIME, MONEY, MATERIALS . . . any number of combinations of dimension, shape, grain size and bond.

Chicago Wheel and Mfg. Co.

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SEND ME SAMPLE CHICAGO MOUNTED WHEELS

Name .....

Firm Name .....

Street Address .....

City ..... Zone ..... State .....

Encircle No. 218 on postpaid card

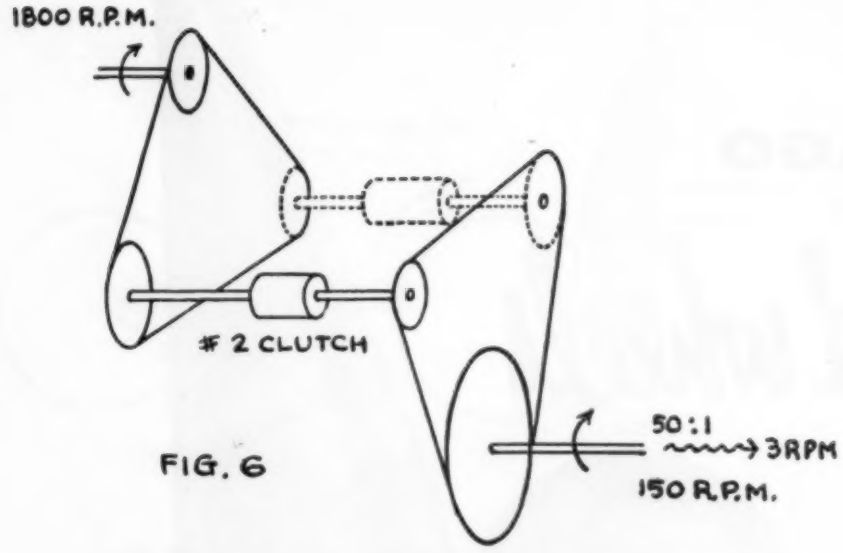

FIG. 6

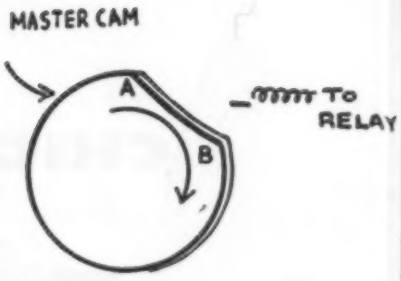

FIG. 7

the grinding action is good, Fig. 3, due to the relatively small contact area. Thus a higher work speed can be employed when grinding this section.

The work speed formerly used was a compromise between the low work speed dictated by the AB section of the cam surface and the higher speed permissible when grinding the rest of the cam surface. While finish grinding, the AB section always sparked out last. The nearly cylindrical portion of the cam surface would spark out much sooner.

It was soon apparent that grinding time could be shortened if two speeds of work rotation could be combined during each revolution of the cam lobe against the grinding wheel. That is, when section AB was contacting the wheel the work would rotate at 3 rpm, and then rotate at 13 rpm during the rest of the revolution.

This was finally achieved by using two Warner Electric clutches in conjunction with two distinct pulley systems. These pulleys and clutches are placed between the work drive motor and the work, Fig. 4. When clutch No. 1 is energized the pulley system in operation drives the work at 13 rpm, Fig. 5. When clutch No. 2 is energized the pulley system drives the work at 3 rpm, Fig. 6.

The two clutches are connected to a single pole, double throw relay so that one is always off when the other is on. In this setup, clutch No. 1 is normally energized, thus rotating the work at 13 rpm. As point A of the cam surface approaches the grinding wheel, a small prod fastened to point A on the master cam closes an electrical circuit, Fig. 7, immediately energizing the relay. This throws out clutch No. 1 and throws in clutch No. 2, thus rotating the work at 3 rpm. The relay has an adjustable time delay before releasing. This delay is adjusted so that the relay deactivates as point B is touching the grinding wheel. This instantly throws out clutch No. 2 and throws in clutch No. 1, again changing the work speed back to 13 rpm. This speed continues until point A again approaches the wheel; then the cycle is repeated.

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Cemented Diamond Particle Tools and Wheels

—How they've been applied recently to the dressing of grinding wheels

by **Dr. C. L. McCabe,** Consultant To The Koebel Diamond Tool Co.

An entirely new technology is developing around the application of cemented diamond tools for the dressing of grinding wheels. These applications take advantage of the diamond's natural hardness without modifications being made to the diamond itself. A notable achievement which introduced new opportunities in this field was the use of powdered metal techniques for the setting of diamond particles. Diamond powder, which has been and will be stably priced and is in adequate supply, dresses grinding wheels to the most acting requirements.

Terminology. The term selected to describe small diamond particles, ranging in size from +20 to —200 U.S. Standard Mesh and embedded in a suitable powdered metal matrix, is "Cemented Diamond Particles," abbreviated to "CDP".

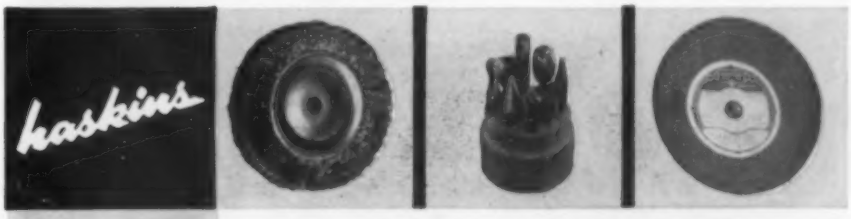
This is an interim report on a development program which is in progress. Several CDP tools are performing well on the production line. The development has and will find use in a great many applications, but it will not replace many of the standard diamond tools in common use today. It will find its place in the family of diamond tools and it is felt that the use of CDP tools will result in the expanded use of diamond dressing of grinding wheels and in the replacement by grinding of some machining operations.

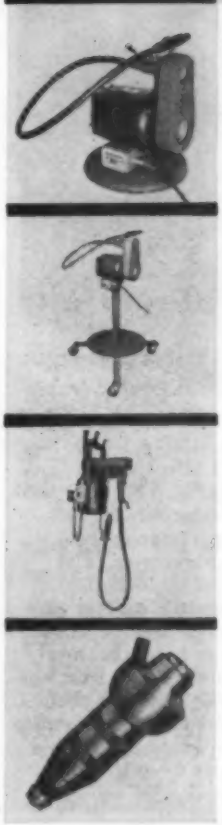
Dressing Grinding Wheels

Diamond Particle Size. One of the most important considerations in the dressing of grinding wheels with small diamond particles is the size of the diamond particles relative to wheel grit size, wheel hardness, and also the depth of dress cut. If the diamond particles are too large compared to a wheel grit size, the wheel will squeal and glaze during dressing and the dressing action will be poor. Diamond particles of small size will be undercut and fall out before very much dressing can be accomplished. If the depth of dressing cut is too large, again the diamonds will be dislodged before getting a chance to do much dressing. If the dressing cut is too small, the wheel will not be put into a "sharp" condition and its face will not be cleaned. The proper combination of these three factors is only determined by experience with the machine, the materials to be ground, the wheel, the specifications of the finish, and the physical dimensions of the work. In general, the average diameter of the diamonds should be double (or more) that of wheel grit diameters, and the depth of cut is the minimum which will allow a free cutting wheel. Equal success has been obtained with organic and vitrified bond grinding wheels. On many jobs, the experience so far gained with the use of CDP tools makes the proper tool selection a relatively simple matter.

By using CDP for dressing, the dressing action is carried out by many small sharp diamond particles acting simultaneously on the grinding wheel. The fact that the diamond particles are small means that it is nearly impossible to have a blunt diamond point dressing the wheel.

There is little published information on just what does happen when a dia-





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Cemented Diamond Tools

continued

mond dresses a grinding wheel. Are the individual grit particles in the wheel fractured or are they merely pulled out? It seems reasonable that, under dressing conditions where the diamond point is sharp and the depth of dressing cut not too great, the individual grit particles of the wheel are fractured and thus sharpened. This is largely based on the observation that on replacing a single point diamond by a CDP tool that, in general, the wheel is freer cutting and more pieces per dress can be obtained even though the dressing cut is the same or somewhat less. An investigation is underway to examine the individual grits in grinding wheels which have been dressed with CDP and with single point tools.

In using CDP tools there are many diamond points dressing the wheel, which, compared to conventional methods, allows a speed-up of the traverse of the diamond dressing tool. This is of course a valuable time saver in many operations. The pattern of diamond marks, present on a very small scale in the wheel, becomes quite complicated compared to the marks left by a single point tool. Whatever this pattern may be, CDP dressing results in surface finishes on the work piece which, in general, are better than those obtained with a single point tool under the same grinding conditions.

CDP tools have long life, since there are many layers of diamond points which can be used before the tool is finally worn out. Long tool life means less down time. A worn out tool can be discarded and does not have to be re-set. In many cases, it is not necessary to turn the tool during its life. In several cases, the design of the CDP tool makes turning impossible.

Design Criteria for CDP Tooling

1. The diamond particles must be of good quality; of the same type of diamond found in first quality stones for single point tools. Inferior grades decrease tool life to such an extent that it is not economical to use them.

2. The diamond particles must be uniformly distributed throughout the metal matrix. Irregular distribution makes the dressing characteristics of the tool vary with time.

3. The diamond particle must be chunky, not elongated in shape. If the elongated stones present their flat sides against the wheel, it will squeal when dressed and consequently become glazed and dull.

4. The metal matrix must hold the diamond particles securely. The matrix must be made of a metal that can be abraded away to allow the diamonds to protrude from the surface of the tool. It is obvious that the matrix should not be too easily abraded away.

5. The particle size of the diamonds must be held to within fairly close limits. Large particles will cause the wheel to glaze and small particles will be undercut and drop out without doing very much dressing.

Typical Tooling Applications

It will be impossible to cover all the details of successful applications of CDP. We feel that a general description of the use of the CDP material in certain applications will point out the salient features of the use of the material.

Shank Tools And Flat Dressing Surfaces

The most prevalent use of the CDP tool today is in the field of thread grinding. Standard tools of this type are in use on Ex-Cell-O thread grinders. The cemented diamond particles extend down approximately ¼ in. from the end of the tool. Perhaps the most important reason for their adoption is their ability to dres the grinding wheel so that sharper roots can be insistently obtained since the edge of the wheel itself is dressed more

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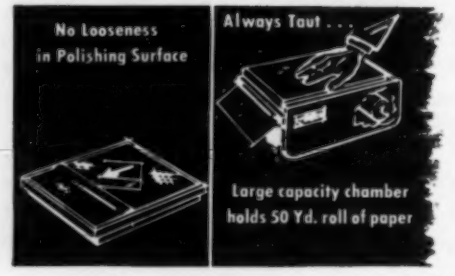

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sharply by a CDP tool than by a single point diamond tool. It also has been reported that it is possible to dress a sharper root flat using the CDP tool. The advantages of longer wheel life are particularly noticed since it has been found that light dressing cuts, less than 0.0005 in., result in a wheel which is free cutting. It is possible that the CDP dressing action results in the actual dressing of the individual grit particle in the wheel.

Another consideration of tools with a flat dressing surface is their production of parts with a good surface finish. The idea that each individual grain of the grinding wheel is dressed provides a plausible explanation for the good surface finish obtained, on a wide variety of internal and external grinding machines, without nearly so many dressings per shift. In one typical case, it is reported that dressings per shift were reduced one-seventh by using the CDP tool instead of a conventional single point diamond. If needed, the individual grit grain is dressed, then a sharp yet relatively flat grinding grain would hit the work piece. The sharpness of the grain insures good cutting characteristics of the wheel, yet the relative flatness of the grain would result in good surface finish. For a particular operation it has been found that CDP dressing allows the use of larger sized grit in the wheel than can be tolerated with single point diamond dressing. No loss of surface finish results and considerable production advantages accrue from this.

For jobs that require a large wheel surface, the time of traverse of the diamond dressing tool is an important factor in production. A sharp wheel, giving the required surface finish, can be dressed with a CDP tool using a faster traverse than that possible with a conventional single point and results in production cost savings. The dressing action of the CDP tool, and thus the quality of the surface obtained, is constant throughout the life of the tool. An examination of the dressing surface of a CDP tool during various stages of its wear, readily shows that, in general, the dressing surface has the same appearance—that is, some diamonds newly exposed and some worn.

Shank Tools—Formed Surface

The possibility of using a CDP tool with a shaped dressing head to dress its form in a grinding wheel has merit in situations where a contour dresser is undesirable. Large diamonds lapped to the form are sometimes used for this purpose, but their cost of manufacture and the cost of the diamond itself is a distinct disadvantage. To do this operation more economically, a CDP

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Cemented Diamond Tools

continued

tool has replaced a lapped single diamond tool of the same form. In the manufacture of the CDP tool, the head containing the diamonds takes the form of the formed mold in which it is made. This means that the bruting and lapping of the diamond particles is minor in nature, compared to the lapping operation to shape a whole large diamond.

Dressing Wheels

In the use of grinding machines for automatic operation, it is desirable to have the diamond dressing tool maintain its shape for long periods. One way to do this is to use many diamond dressing points rather than one or a few. Thus the wear on the diamond is distributed over many points and the diamond—containing dressing device will maintain its shape for a long time. One simple way to do this is to use a CDP diamond wheel rather than a diamond tool for dressing.

The application of a separately driven CDP diamond wheel to dress a grinding wheel was demonstrated for the first time by Jones and Lamson on their Model E form grinder. This application was shown at the National Machine Tool Builders Show in Chicago in September, 1955.

Dressing Blocks

An interesting application of the CDP material has been in the shaping of a grinding wheel on a surface grinder with the use of a CDP block, which has the same shape of the desired form which is to be ground. An application where this principle has been used is in the grinding of V-Notches in hard steel specimens for Charpy impact testing. At this writing 500 specimens have been notched and have held within the standard limits set on the Charpy V-Notch without any noticeable wear on the diamond block. The sequence of operations is as follows: The CDP block is placed in the holder in such a position that the notch in the block containing the diamond particles is exactly lined up with the place where the notch is to be ground in the specimens. The work table is passed back and forth and a dressing of the wheel is automatically accomplished with each pass. The physical setup absolutely insures that the finished notch will have the same contour as the diamond containing notch. In this operation the depth of cut each time was 0.0005 in. A generous supply of coolant was provided.

Conclusions

It is felt that sufficient progress has been made in the use of CDP tools and wheels for the dressing of grinding wheels to warrant additional research and development. The work could take several directions: (1) wheels dressed by CDP and by single point tools could be carefully examined and compared; (2) the design and action of dressing devices should be reinvestigated with the thought of taking fullest advantage of multiple diamond point dressing as well as other methods; (3) suggestions should be made to diamond tool manufacturers for improved designs of tools and wheels; and (4) wheel manufacturers might see if modifications of existing wheels will result in more efficient operations with CDP diamond dressing.

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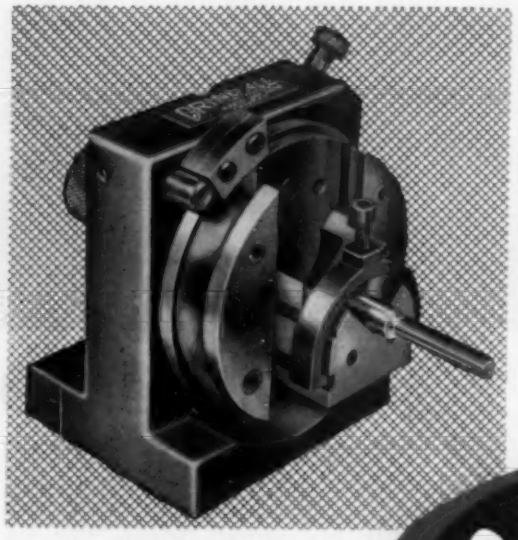

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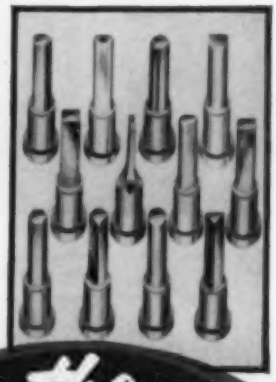

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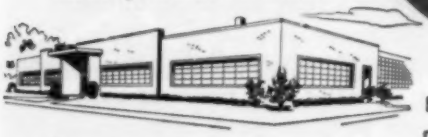

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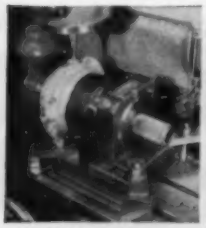

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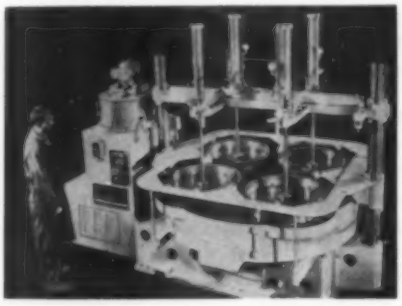

Two adjustable supports have been added to the roller bar. These keep the roller bar on even plane so that it can be conveniently stacked with parts during loading or unloading of the machine.

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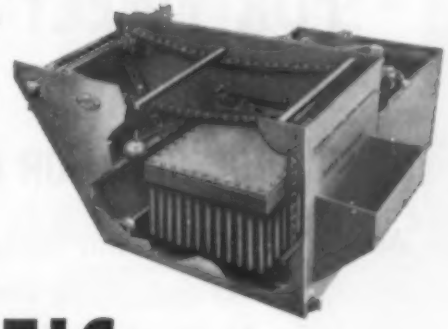

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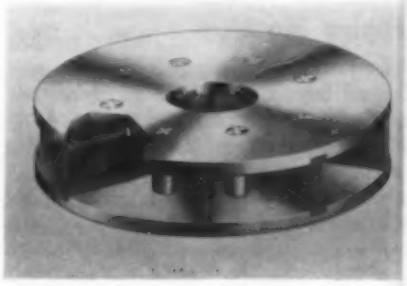
New Abrasive Throwing Wheel for Blast Cleaning Machines

A new type of wheel for centrifugally propelling abrasive in airless blast cleaning has been developed by Wheelabrator Corp. Known as the GM Wheelabrator unit, it is currently available for use on airless abrasive blast cleaning equipment already installed in plants, as well as on machines being manufactured. It is presently available in the 2½" wide x 19½" diameter size.



Cut-away view of GM wheel, with blades held in place by spring-type locking devices.

The GM wheel is claimed to reduce maintenance costs that result from wear, which is accomplished by a new method of holding the wheel blades in the wheel. Whereas a set screw and set screw bushing were formerly used for this purpose, the GM wheel employs a simple spring arrangement. The new locking device is not in the abrasive blast stream. Important from a maintenance standpoint is that it can be inserted or removed with a common tool like a screw driver. •

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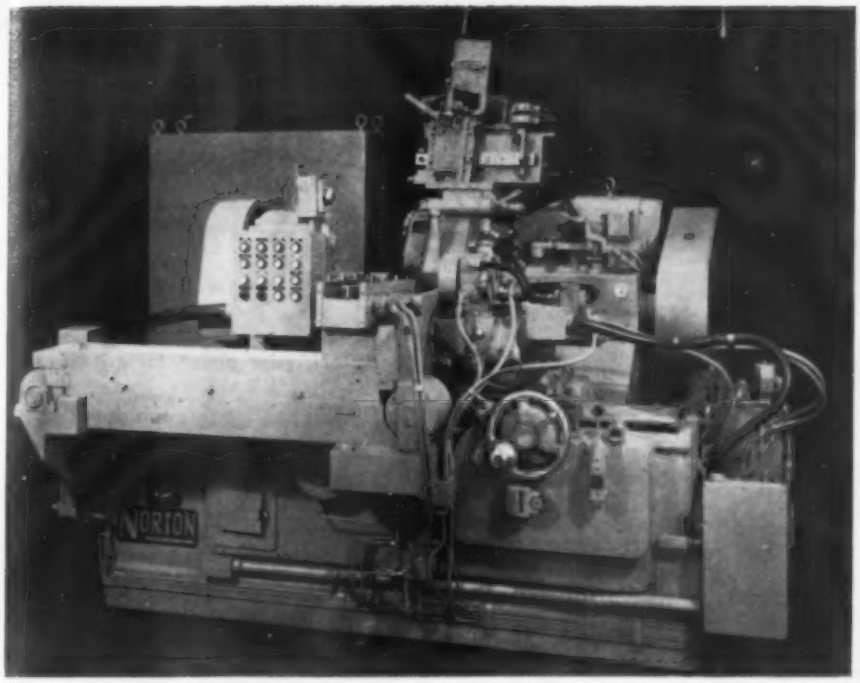

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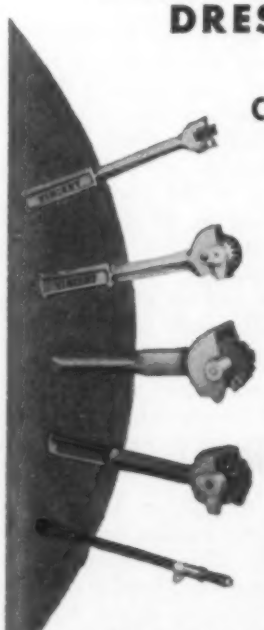

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RESINOID DIAMOND WHEELS

— the best diamond wheel bond ever developed—
if you've used them - you know they're best!
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UNITED STATES DIAMOND WHEEL CO. AURORA, ILL.

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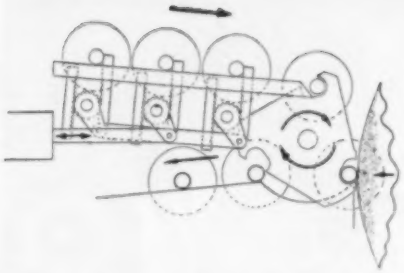
Stem Pinion Grinder

continued

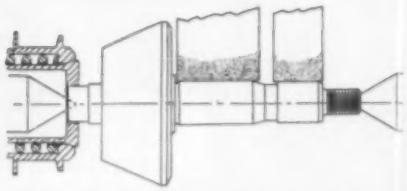
and driving equipment and automatic loading and unloading devices. This makes it possible for one operator to supervise the output of more than one machine.

Because of the awkward, top-heavy characteristics of automotive type pinions, there has always been a high fatigue factor in manual loading of such parts. The new grinder's loading mechanism includes a chute which automatically moves the pinion down inclined ways toward a revolving turret. The turret then places it in position for the footstock center to engage the center hole and push it forward into the floating type collet on the headstock. The grinding cycle time is preselected on the basis of stock removal and finish required. On completion of the grind, the revolving turret takes the pinion from the centers and discharges it into an unloading chute from which it rolls onto the conveyor in front of the machine.



Schematic view of loading device.

The time-and-effort saving functioning of this automatically operating machine results in high production in grinding diameters of automotive stem pinions. Diameters on these parts are rapidly ground simultaneously—in a single, automatic plunge grind.



Floating type spring actuated collet on headstock grips pinion for grinding.

In their passage through the machine, the stem pinions are controlled by an automatic loading mechanism which moves them down inclined ways toward a revolving turret. The turret takes the foremost pinion and places it in position for engagement by the footstock center and driver. Interlocks then cause the footstock center to advance automatically. As it does so, the center picks up the center hole in the work on its carbide-tipped point and pushes the pinion onto the headstock center at which time it is firmly gripped by a floating-type collet and ground.

The grinding cycle time is preselected on the basis of stock removal and finish requirement. Upon completion of the grind, the revolving turret takes the pinion as it is automatically released from the centers, and discharges it into the unloading chute from which it rolls onto the conveyor on front of the machine.

Grinding wheel truing is performed automatically at predetermined intervals by a wheel head mounted device. This device produces substantial time savings—especially so where size relationships between wheels must be maintained—as in the case of simultaneous grinding of the diameters on a stem pinion. Further, it provides the extra advantage of giving close control of the amount of abrasive removed from the faces of the wheels, thus reducing wheel cost per piece ground.

Automatic Wheel Head Resetting

A special mechanism is provided which eliminates another conventional operating duty. This automatically resets the grinding wheel head to compensate for the reduction in the diameter of the grinding wheels which occurs after truing.

Interlock controls further reduce the need for close attention by assuring that the automatic actions occur in proper order. Improper action stops the machine. In addition, a large master stop button of the mushroom-type is

NO. 1 *"Roughing it"* with Reddy MacFlint

"Tricky shot — smooth club . . . what a finish! You know AP Jewel Brand Belts are used to finish the finest 'woods' including brassies and drivers that combine metal and wood."

"Smoothing the way where the going is rough"

Frequently AP salesmen are able to provide unusual service in supplying abrasives because their plant is neither too big to lose the personal touch nor too small to lack emergency capacity.

Abrasive Products, Inc.
South Braintree 85, Mass.

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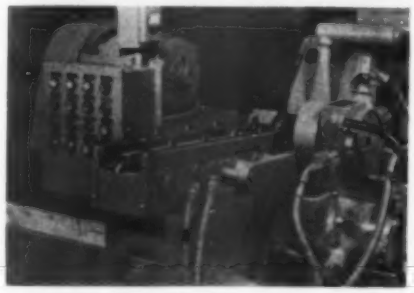
conveniently mounted on top of the push-button control panel for assistance of the operator should he desire to momentarily stop the machine for inspection purposes.

The headstock is an all vee-belt drive type, heavily proportioned for rapid grinding. It is "straddle-clamped" across the table for sustained alignment. The "floating-type" work drive collet clamps the work by spring pressure. The collet is unclamped for work release by a hydraulically actuated arm. Work is supported during the grind on a 1¾" diameter center.

The footstock, also "straddle-clamped" across the table for sustained alignment, has a spindle and center which is advanced and retracted hydraulically. The spindle is supported in



Closeup of empty loader.

micro-lapped heat treated sleeves for accurate action.

Automatic Wheel Feed

The wheel head is brought into grinding position rapidly by hydraulic power. The automatic grind occurs by hydraulic rotation of the feed screw in its nut, which gives fine accuracy through metal-to-metal contact of feed screw and nut which are lapped together and mated during manufacture. A "click-count" indexing mechanism on the wheel feed hand wheel speeds set ups for automatic feed by permitting increments as fine as .0001" to be set without visual attention.

The length and rate of automatic feed are controlled from the front of the automatic stem pinion grinder. This is another time-saving feature. Control of the length (or amount) of the automatic feed is made by setting the wheel feed hand wheel which is graduated in increments of .001" stock removal and by rotating the "click-count" index to establish the settings in "tenths." Control of the rate of feed is accomplished by rotating the knurled knob of a needle valve which is also on front of the machine.

The wheel spindle unit contributes to the high output quality of the machine through its resistance to grinding wheel pressures. The wheel spindle body is supported for over 50% of its length in hard bronze bearings which

What is YOUR

GRINDING WHEEL PROBLEM?

We like to keep our engineers on their toes solving new and tough grinding wheel problems.

What are some of your "hard-to-do" grinding jobs—could be we can make them "easy-to-do"!

Write for details or the name of your nearest distributor.

SWWC

SIMONDS WORDEN WHITE COMPANY

1101 Negley Place • Dayton 7, Ohio

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W&B LUBRICANTS AND COOLANTS IMPROVE EVERY GRINDING JOB!

Sixty-seven solid years of *specialized experience* stand behind White & Bagley Grinding Lubricants and Coolants. Here are some of the W & B products that are *boosting production, reducing grinding costs,* and *producing better finishes* for more and more plants throughout the world:

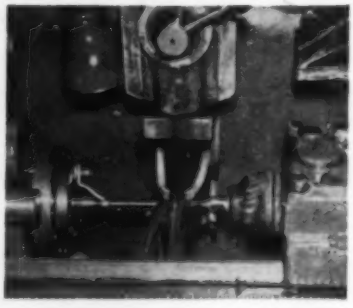
W & B Lubricant 1888 insures rapid and clean stock removal; keeps wheels open and free-cutting; permits the use of finer wheels to produce smooth finishes.

W & B Grinding Concentrate 1500 transparent and foamless; gives unusually keen grinding action and rapid chip settling; for grinding ferrous metals.

Courtesy, Norton Company

W & B Grinding Lubricant E-1 produces the highest reflective finish; permits rough grinding and finishing with the same wheel.

W & B Grinding Oil 1572 for close-tolerance, critical oil grinding; especially desirable on machines which perform a wide range of oil-grinding operations.



Courtesy, Jones & Lamson

W & B Base L adds potency (sulphur and fat) to petroleum or cutting oils to give improved results in grinding and machining.

Let us help you with *your* needs for grinding lubricants and coolants. We specialize in *your* requirements. For further information, mail the coupon today!

THE WHITE & BAGLEY CO.
Worcester, Mass. Detroit, Mich.
Originators of Grinding Lubricants

W&B INDUSTRIAL LUBRICANTS

The White & Bagley Company
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☐ 1888 ☐ 1500 ☐ E-1 ☐ 1572 ☐ Base L

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Company_____

Street_____

City_____ Zone____ State_____

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Stem Pinion Grinder
continued

are force-feed flooded with filtered lubricant. Lubricant flow is adjustable and is visible continually through bull's-eyes on the spindle housing. Bearing length is over twice the diameter which results in low unit pressure and permits heavy grinding cuts to be taken. A heavy duty flood lubricated end thrust bearing at the center of the spindle assures lateral stability.

Maintenance Features

Motors, pumps, filters and relief valves are positioned on the outside of the machine in areas which afford

Left front closeup view.

accessibility for maximum ease in servicing. Electrical controls are housed in a separate enclosure for protection and for ease of inspection. The coolant tank has a ramped outlet for speeding tank clean-out, and the grinding wheel guard has a hinged cover for easing wheel change. The machine conforms to J.I.C. Standards electrically and hydraulically.

Specifications

Headstock
Spindle diameter .....4⅛"
Center diameter .....1¾"
Center taper .....No. 14 Jarno
Footstock
Spindle diameter .....2¾"
Center diameter .....1¾"
Center taper .....No. 14 Jarno
Wheel Slide
Length of bearing ways .....37⅜"
Width of flat way .....5⅞"
Width of vee way (projected) 4-11/32"
Overall width of ways (projected) ..... 20⅞"
Total bearing area (projected) ..... 372 sq. in.
Lubrication .....Automatic Pressure
Wheel Spindle
Material ..... Heat treated Alloy Steel
Large bearing (L.H.) ..3½" x 8-5/16"
Small bearing (R.H.) ..3¼" x 7-⅛"
Number of speeds 3
Diameter of pulleys .....14⅛", 11-5/16", 9-9/16"
Drive from motor .....9 Vee belts
Lubrication .....Automatic flood
Motors
Wheel drive .....15 H.P., A.C.
Work drive .....1 H.P., A.C.
Pump drive .....1½ H.P., A.C.
Coolant pump drive ....¼ H.P., A.C.

• • •

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Engelberg Introduces Rotary, Automatic, Platen-Type Belt Grinder

For high-speed precision grinding and finishing of outside diameters, a new automatic rotary abrasive belt grinder has just been introduced by Engelberg Huller Company, Syracuse, New York. The new wet-or-dry belt grinder, for o. d. grinding of ferrous and non-ferrous metals, plastics, ceramics, glass and other materials, is designed to handle circular parts from 26 inches to 40 inches in diameter, and can be modified to meet other diameter ranges.

The self-contained motor-driven work table rotates at standard speeds of either ¼ or 3 revolutions per minute, with optional change gears for other rpm requirements. An air-controlled infeed mechanism carries the rotating parts in against the belt and infeed travel is adjustable with a minimum of .0016-inch per revolution.

For even distribution of belt wear, the parts are moved back and forth across the belt face by means of an air-hydraulic reciprocating device, with 7-inch oscillation stroke. The table is adjustable from 0 to 45 degrees for angular grinding.

For applications requiring deburring, such as stator rings or bucket wheels, a tampico brush attachment is provided as an optional attachment. The brush is moved in against the belt-ground work by a manual control wheel, and can be swiveled to coincide with grinding angle of machine table.

Standard abrasive belt size is 8 x 107 inches, with belt speed available from 2000 to 5000 sfpm, depending on application. Capacity of coolant unit, equipped with a ½ h.p. coolant pump, is 100 gallons.

Engelberg Huller Company, 831 West Fayette Street, Syracuse 4, New York. •

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In an iceberg or in a J. K. Smit Diamond Tool only a fraction shows above the surface.

Everyone knows of the unseen portion of an arctic iceberg. Many do not realize the unseen factors that lie beneath the surface of a J. K. Smit Diamond Tool.

Our constant research to find still better methods of manufacturing Diamond Tools, the unquestioned integrity of our company since 1888, the manufacturing skills that have been learned and passed on through all those years, and quality control of manufacture for tool duplication.

All these hidden assets count much toward maintaining our position as a leader in the industry today.

When *your* next job specifies a diamond tool for any purpose contact J. K. Smit. Our field representatives are trained and qualified to assist you with any standard or special application.

J. K. SMIT & SONS, INC.
HOME OFFICE AND PLANT
MURRAY HILL NEW JERSEY

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What's New

continued

Norton Cylindrical Grinder Handles Large Workpieces

A new cylindrical grinding machine for precision grinding of large, relatively light weight workpieces has been developed by Norton Company. The Norton 30″ Type LCTU Semi-automatic Cylindrical Grinder is available in work lengths of 48″, 72″ and 96″, and will handle work up to 30″ in diameter.

Wide tables and ways are built into the machine. Wheel spindles run in long, pressure lubricated bearings. Automatic or manual wheel feed settings are aided by "click-count" wheel feed index with which feed increments as fine as 0.0001″ in work diameter reduction are set without visual attention. Wheel feed is accomplished by means of a rotating screw type automatic wheel feed mechanism.

The automatic cycle is actuated with a single lever located at the operator's position, and terminates either manually or by an electrically timed control. A jogging lever permits fractional rotation of the work to the most convenient position for loading or inspection.

Operation is also simplified by a preset table truing and grinding speed control feature. This permits maintenance of separate table speeds for truing and grinding as set from the first workpiece. It provides either speed immediately thereafter by short movement of the table control lever.

A wide variety of optional accessories for the 30″ LCTU increases its efficiency for special jobs. Locating devices,

automatic wheel truing, automatic compensation of wheel head setting after truing, and a lever operated device which moves the grinding wheel into a shoulder to be ground, are available as extras. •

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Tough Grinding Wheel Forms Dressed Easy as A, B, C

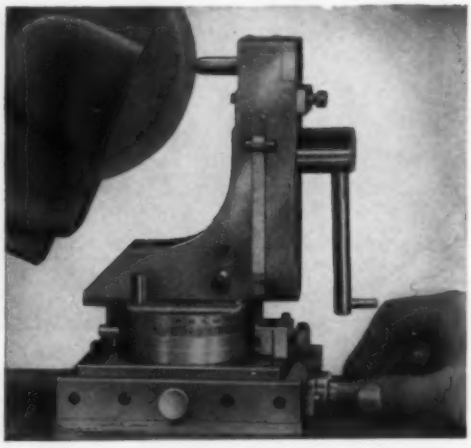
eliminate elaborate set-ups and operations

.0001" ACCURACY

Fluidmotion

WHEEL DRESSERS

dress two angles tangent to a radius in one continuous motion



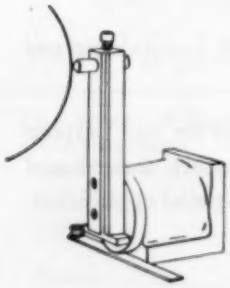
With the unique "Fluidmotion" Dresser, you can dress two angles tangent to a radius — using one handle in one continuous motion. Operation is so fast and simple that beginners can use them.

Adaptable to all type cylindrical and surface grinders.

A. Obtain micrometer reading; add required convex radius or subtract required concave radius.

B. Loosen jib with wrench and "mike" over lower pins to reading obtained above.

C. Tighten jib. Set stops for two angles. Ready for action.



Also available: "FORM MASTER" Dresser, capable of dressing any radii up to 12" convex, up to 15" concave.

See your industrial distributor or write for free literature.

J&S TOOL CO. INC. — CLAMPCUT

J & S TOOL CO., INC. | 871 DORSA AVE. LIVINGSTON, NEW JERSEY

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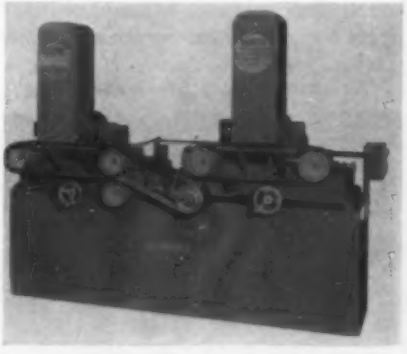
Double Side Belt Grinder

Near automation, in the grinding, polishing and deburring field, is made available with the new Model 304C2 Double Side Grinder manufactured by the Curtis Machine Corporation. Incorporating a turn-over transfer unit between conveyorized abrasive belt heads, this version of the Curtis "Straight-O-Matic" machines will grind, polish or debur both sides of a work piece in one handling of the stock. The turn-over mechanism allows grinding and polishing of pieces of different sizes and shapes.

The Model 304C2 uses abrasive belts 4″ wide x 54″ long and incorporates a 1½ HP abrasive belt motor and two ¼ HP infinitely variable speed conveyor drives. The 304C2 is the smallest



in the Curtis "Straight-O-Matic" line. Optional equipment includes additional tandem heads, wet grinding, oil mist, hold-down rolls and magnetic chucks.

Curtis Machine Corporation, Jamestown, New York. •

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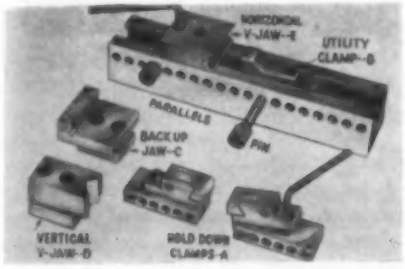
Work-Holding Clamps

Clamp-All parallels, a light-weight clamping system for holding operations on all types of machines, has been introduced by Jerico.

Interchangeable jaws handle a wide range of work pieces and also hold all non-magnetic materials. Individual parallels are finished to a tolerance of .0002", and matched pairs can be used to hold odd shaped and larger work.



Clamp-All parallels consist of a Meehanite parallel bar and six attachments. The "D" jaw, for vertical holding of rounds or shapes; the "E" jaws, for horizontal clamping of rounds or shapes; "B" clamp, which fulcrums on the lower hinge and is held in place with a hardened ground pin located in holes jig bored through two sides of the parallels and through the base of the clamp which slides in the slot of the parallels; "A" hold down clamps, developed with a spring loaded feature so that when tightening on the screw, these clamps push in and down. This feature eliminates the requirements of pounding or hammering the work into a flat position. The holes in the clamps (Type "B" as well as Type "A") are verniered so that quick location and minimum locking action is required.

The Clamp-All with a capacity from 0 to 12 inches weighs only fourteen pounds.

Clamp-Alls are available in matched pairs with a maximum opening of 65". Jerico, 4744 West Lake Street, Chicago 44, Illinois. •

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Sheffield Shows New Ultrasonic Tool

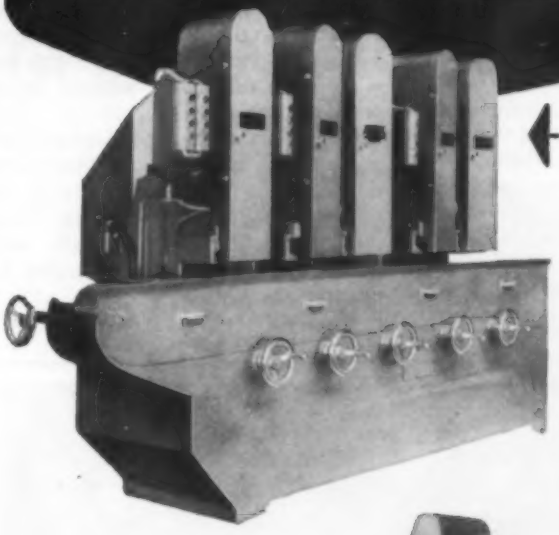
A new portable hand type "silent sound" tool revealed at the Cleveland National Metal Congress & Exposition will enable both small manufacturers and individual craftsmen to perform ultrasonic machining operations.

Development of the new unit, an adaptation of the Cavitron ultrasonic cutting process widely used in dentistry, was announced and demonstrated by Jack T. Welch, general manager of the Machine Tool Division of the Sheffield Corporation, Dayton, Ohio. Sheffield is licensed by Cavitron to produce and

Double Production

by grouping several operations on one

Engelberg Abrasive-Belt Grinder!



MODEL 680-5

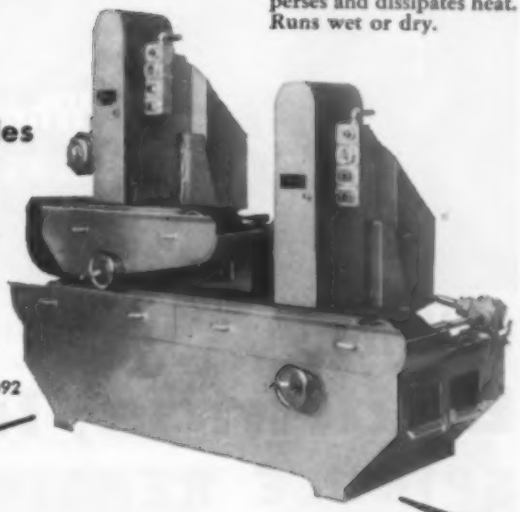
Multiple-Head Grinder Available up to 6 Heads

Single-cycle grouping on 5-headed machine above might include: deburring, flat-surfacing, sizing, polishing and fine polishing. Stock removal is at high speeds. Large grinding area, long belt disperses and dissipates heat. Runs wet or dry.

For Grinding Both Sides of Flat Work

Piece-work first passes under grinding head at left, then is carried around bend to bottom conveyor belt. Unground face is now *up*, positioned for passage under second grinding head at right.

Model 2-1092



PRODUCTION INCREASES OF 100% AND UP are not uncommon with the high-production semi-automatic abrasive-belt grinders shown here. Fine finishing to close tolerances may be done on *any* ferrous or non-ferrous metal, plastic or other material.

Precision manufacturing of these and scores of other models has provided facilities and experience ideally suited to the solution of problems in abrasive grinding. Our methods-engineers will gladly go over your drawings or samples of typical production pieces for operational analysis—no cost or obligation. Just write.

The ENGELBERG HULLER Co., Inc.
329 Seneca St., Syracuse, N. Y.

ENGELBERG PRECISION ABRASIVE-BELT GRINDERS

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What's New

continued

market the equipment solely in the industrial field.

The Cavitron technique uses the impulses generated by ultra-sonic frequency waves and transfers these impulses into high speed mechanical oscillations of abrasive or cutting tools. These movements are electrically controlled to perform a variety of cutting, slicing, machining, tapping, dicing, engraving and embossing operations. The harder and more brittle the material to be cut, the faster the ultra-sonic tool penetrates in the cutting and machining process, it was stated, thus permitting both industry and craftsmen to use many new materials once thought to be unusable because they could not be machined.

The "silent sound" process also contributes importantly to industrial safety since the cutting action of the apparently motionless tool is effective only on extremely hard substances and harmless to anything resilient, such as a machine operator's hand or finger. The operator can even touch the tool while it is oscillating without injury or even a sensation of pain.

Major manufacturing industries' growing success in using the silent ultra-sonic process for a variety of cutting and machining operations, Welch said, points the way to equally wide use of the technique by smaller industries.

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Gentlemen:
I'd like to have complete information on your spindle repair service.
Name_____
Firm_____
Address_____
City_____ Zone_____ State_____

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New Fire-Resistant Hydraulic Fluid for Special Applications

A new fire-resistant hydraulic fluid, Houghto-Safe 1020, has been developed by E. F. Houghton & Co. which has been compounded expressly for systems operating at temperatures above 150°F. and for heavily loaded pumps and bearings.

The new fortified fluid is a companion to the original Houghto-Safe 620 pioneered by Houghton five years ago. Over 2 years ago, Houghto-Safe 620 was installed in the hydraulic catapults of U. S. Navy aircraft carriers.

The new companion fluid to Houghto-Safe 620 is a fortified synthetic material, and is designed for systems which run hot—150°F. and above—and for heavily loaded pumps and bearings. In addition to greater film strength and lubricity this new fluid is fortified with rust preventives and anti-foaming agents.

E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa. •

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Tissues Clean and Fog-Proof Lenses in One Operation

New chemically treated tissues will clean and fog-proof lenses in one operation . . . with plain water. Lenses are merely wetted and wiped with No-Fog Lens Cleaning Tissues . . . no other chemicals are necessary. They may also be used dry for cleaning or polishing.

Chemicals in the tissue are harmless to the skin and are non-abrasive. They may be used on glass or plastic goggles, eye glasses, face shields, gas masks, etc.

Carhoff Company, 11706 Kinsman Road, Cleveland 20, Ohio. •

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Disc Support for Depressed Center Grinding and Cutoff Wheels

A new soft rubber disc support for depressed center laminated grinding and cutoff discs has been announced by The Nedco Corp., Waltham, Mass. The new support is said to cushion the disc and guide it from the hub rather

than from the nut. This support absorbs and deadens vibration caused by misalignment or by off-balance discs, resulting in a better grinding job and less operator fatigue. The supports are available in 5", 6", 7", and 9" sizes. Hub threaded ⅝ x 11 unless otherwise specified.

The Nedco Company, 27 Jones Road, Waltham, Mass. •

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Combination Frame Safety Spectacles

Welsh introduces new Series 2800 combination metal and plastic frame safety spectacles with broader vision, square shape lens. Spectacles feature metal bridge and metal eye wires with colored plastic upper frame structure. They are available with green or clear

heat treated glass or CR-39 plastic lenses.

For specifications on Eye Sizes, Bridge Sizes, Temples and Frame Color, write for Bulletin No. 28. Welsh Manufacturing Company, 24 Magnolia Street, Providence, R.I. •

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CLIPPER

PRECISION DIAMOND TOOLS

Industrial Diamonds
Thread Grinders
Turning Tools
Engraving Tools
Dressing Tools
Diamond Powder

Manufacturers of
DIAMOND TOOLS
and
WHEELS

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PHILADELPHIA, H. J. MILLER, Valley Brook Rd. and Glen Mawr Dr., Ambler, Pa.

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CLIPPER DIAMOND TOOL CO., INC.

345-E HUDSON ST. NEW YORK 14, N.Y.

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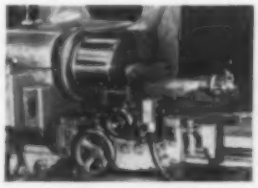
"The Sky's The Limit" when it comes to profitable uses for MAGNA-LOCK CHUCKS

Your investment in a Magna-Lock electro-magnetic chuck is an investment in *versatility* which pays real dividends many times over. In addition to normal surface grinding operations, users are constantly finding new and practical applications of the *extra holding* power of Magna-Lock Chucks for jobs such as these:

MILLING OPERATION

66% reduction in setup time for milling cast iron gibs at Turchan Follower Machine Co.



LATHE OPERATION

Holding 1/16" thick steel discs for grooving. Production, 300 pieces per hour. Wabash Div., Raybestos Manhattan Co.

TRANSFERRING PARTS

loading and unloading water heater shells at Permaglas Div., A. O. Smith Corp.

FLAME HARDENING

LAYOUT WORK

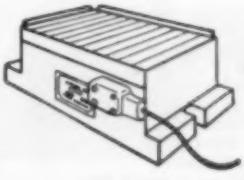
HAND FILING

Your jobs, too, can be done faster, at less cost through the *22% extra holding power* of Magna-Lock Chucks—all steel, moisture-proof, shock-proof. Rectangular chucks from 5" x 10" to 30" x 96" working surfaces—rotary chucks from 6¼" diameter face to 72" diameter—swiveling chucks from 5" x 10" to 12" x 84".

To get the most for your money, specify Magna-Lock. To make the most of Magna-Lock versatility, consult our engineers about your idea or problem. We'll be happy to work with you.

WRITE DEPT. GF-116

Request Magna-Lock as *original* equipment on your new machines.



Hanchett MAGNA-LOCK CORPORATION

BIG RAPIDS, MICHIGAN, U.S.A.

designers and makers of a complete line of magnetic chucks and devices.

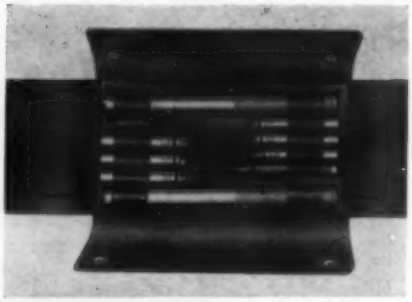
Encircle No. 236 on postpaid card

What's New

continued

Diamond Tool Kit

A compact "general purpose" diamond tool kit has been introduced by Abrasive Dressing Tool Company, Detroit. The kit contains seven tools, 2 tool holders and key. The set is designed to meet all shop requirements and is particularly useful in small shops. A complete instruction folder is included and each kit is backed by a registered guarantee. The company states the kit with its calf leather case represents a $75.00 value, but is being offered for a limited time at $49.95.



Abrasive Dressing Tool Company, 14528 Second Blvd., Detroit 3, Mich. •

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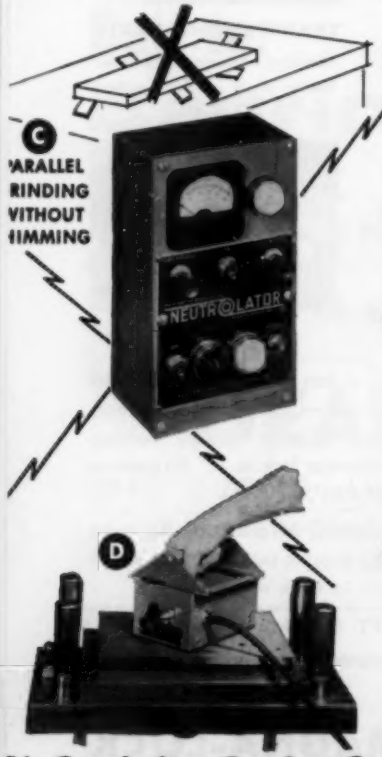
electrical controls for Full Magnetic Chuck performance



The Best Is None Too Good For Your Cutting Tools And Dies

A ELECTRO-MAGNETIC CHUCK CONTROL

Releases and demagnetizes work pieces simultaneously. No time lost. No damage to work or chuck face. Protects chuck from voltage surges. Speeds production. Chuck capacities: 50 to 15,000 Watts . . . 60 to 20,000 square inch chuck area.

B ELECTRO-MATIC RECTIFIER

Power conversion Unit, proved for dependable use with Magnetic chucks and other direct current equipment, from 50 Watts to 40 Kilowatts.

C NEUTROLATOR HOLDING POWER REGULATOR AND CHUCK CONTROL

Provides regulation of holding power which permits grinding without shimming, to closer parallelism than ever before possible. In production grinding where holding power must be the same with each work piece, Neutrolator reproduces the same tension on successive pieces without readjustment. Where various tensions are required, a simple dial or push-button control provides regulation of holding power.

D ELECTRO-MATIC A.C. DEMAGNETIZER

Demagnetizes dies, punches, cutters, tools that have been magnetized from any source. Works by simple contact. Operates on standard A.C. voltage. Will not overheat through constant use. A size for every purpose.

ELECTRO-MATIC PRODUCTS CO.

2237 N. Knox Ave. Chicago 39, Ill. (U.S.A.)
Telephone: BElmont 5-4010
Encircle No. 237 on postpaid card

Portable Lift Table Has 4000 lbs. Capacity

Southworth Machine Co. announces an addition to the company's line of automatic skid lifts and skid turners —the Strongback Lift Table. The new Lift Table is designed to elevate skid or palletized loads to correct feeding, working or positioning heights for machine, process or assembly operations.

Small and compact enough to slide between the legs of any standard skid, the Strongback has an unusually high

ratio of load capacity to size. Platform dimensions are 24″ x 53″. Collapsed height is only 7¼″. Yet its capacity is 4000 lbs., with a stroke or lift of 30″.

Southworth Machine Co., Portland, Maine. •

Use HANDY Postpaid Card. Circle No. 118

Direct Reading Micro Scale

A new measuring scale or rule called an EMscale available in lengths up to 12 inches and sub-divided throughout its entire length into increments of 1/1000 of an inch (.001″) is announced by the Elliott-Myers Corporation of Warren, Pennsylvania. The accuracy of these new scales is one ten-thousandth of an inch (.0001″) or better. Graduations are numbered every fifty thousandths (.050″).

EMscale mounted in aluminum holder with two leveling screws for attaching scale to machine or fixture.

The scale or rule is viewed through a simple type of microscope that makes it as easy to read as a standard mechanics rule. Two sets of numbers are always in view so that correct direction

Closeup, showing EMscale divisions as they appear when viewed through microscope with vernier eye piece making it possible to read direct to one ten thousandth of an inch (.0001").

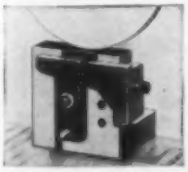
of movement is indicated. By using a microscope incorporating a vernier eye piece, the .001" increments are divided into tenths, making possible direct

LASSY MASTER V-BLOCK

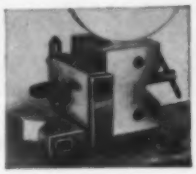
ANGLE PLATES

This Master V-Block Angle Plate is an improved new design. Saves hours of setup time. Assures precise work accuracy. Requires less skill.

Side Gage automatically squares work precisely and without removing angle plate from chuck. Repetitive accuracy maintained.



Adjustable parallel holds the smallest work for position and clamping with ease and accuracy.



LASSY MASTER Angle Plate provides a master setup for regrinding of worn or inaccurate Angle Plates.

WRITE FOR DESCRIPTIVE LITERATURE

LASSY TOOL COMPANY

PLAINVILLE, CONNECTICUT, U.S.A.

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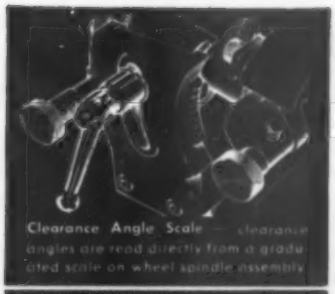
Only Cutter Grinder in the WORLD with all these features

END MILL **CENTRA·POINT** GRINDER ®

Specifically designed for sharpening the small cutters that are so difficult to grind on large machines, CENTRA-POINT is fully described in Bulletin M-55.

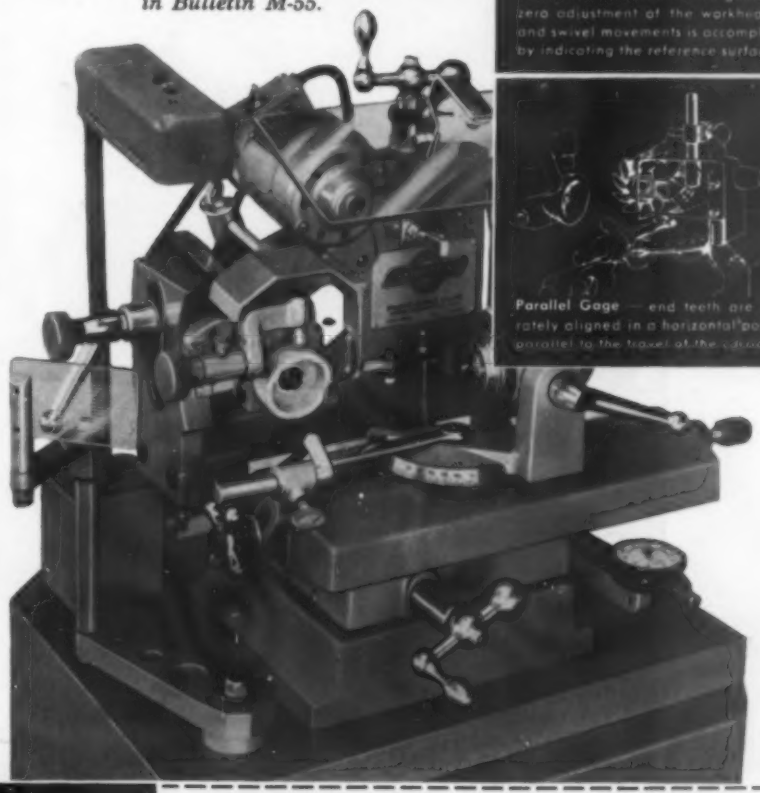


Clearance Angle Scale — clearance angles are read directly from a graduated scale on wheel spindle assembly.

Mechanical Wheel Dressing — an accurate radius is mechanically dressed on the grinding wheel, in correct relationship to self-registering tooth rests.

Reference Surfaces for Alignment — zero adjustment of the workhead tilt and swivel movements is accomplished by indicating the reference surfaces.

Parallel Gage — end teeth are accurately aligned in a horizontal position parallel to the travel of the carriage.



CENTRA-POINT DIVISION

William H. Field Co., Inc., 331 Dorchester Ave., Boston 27, Mass.

Please send a copy of the new CENTRA-POINT Data Sheet.

Name _____ *Title* _____

(Please Print)

Company _____

Address _____

City _____ *Zone* _____ *State* _____

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What's New

continued

readings to a ten-thousandth of an inch (.0001") over the entire scale.

EMscales can be manufactured of many materials, so that for very precise work where thermal expansion must be considered, the scale can be furnished on the identical material that is being measured. This eliminates necessity for temperature control of the working area.

EMscales can be produced to customers' own requirements in medium or quantity production, with any subdivision required.

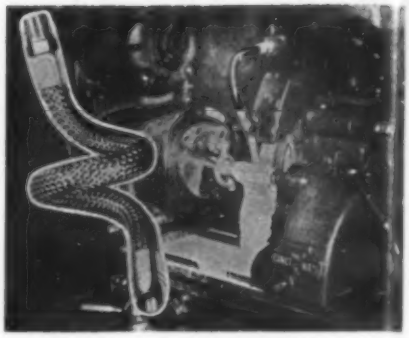
Elliott-Myers Corporation, 117 Hammond Road, Warren, Pennsylvania. •

Use HANDY Postpaid Card. Circle No. 117

Kling-Flo Coolant Assembly

A new aerator-type coolant assembly features a plastic coolant hose that can be twisted and turned into any bend. Its one-piece aerator nozzle is said to eliminate splash and coolant throw-off.

Named the Kling-Flo, it is being manufactured by the Cobon Plastics Corp., of Newark, New Jersey. The Kling-Flo vigorously mixes tiny air



bubbles into water-soluble coolants. These bubbles are formed just as the liquid coolant leaves the assembly.

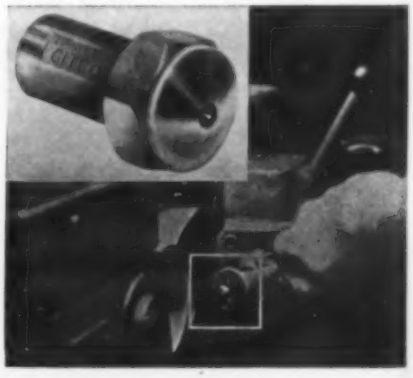
A special steel-clad armor protects the flexible plastic coolant hose from chips. The hose is also impervious to acids and oils. Its flexibility allows the assembly to assume any bending radius. Any combination of assembly lengths, fittings, and accessories are available.

Cobon Plastics Corp., 44 Lafayette St., Newark 2, N.J. •

Use HANDY Postpaid Card. Circle No. 118

Citco Turnit Dresser

The Citco Turnit diamond dresser is said to encourage frequent turning without removing or readjusting the diamond tool. Fewer re-sets and fewer dresses are claimed. Citco turnit is said to enable a wide range of wheel dressing operations to be performed with one size of diamond, reducing inventories. The tool has a hardened and ground



steel shank, a Beryllium copper head, and no wearing parts. Manufacturer states that the tools cost no more than standard tools. Shank diameters of ¼", ⅜" and 7/16" are offered. The Cleveland Industrial Tool Company, Inc., mailing address: Skaneateles, New York. •

Use HANDY Postpaid Card. Circle No. 119

Nozzle Controls Air Flow for Cleaning

An operator can now have complete control of air flow, from a slight puff

Walker Chucks

You May As Well Have the Best

Walker Longitudinal Bar Pole Chucks . . . three popular sizes . . . low wattage, low price, maximum holding.

5" x 10"	$ 78.00
6" x 12"	$110.00
6" x 18"	$185.00

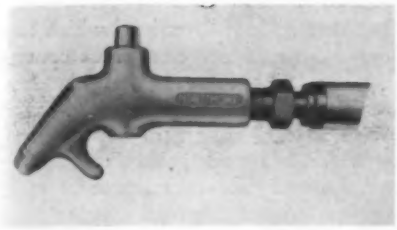
KD Rectifier with built-in switch to operate from any AC line $43.00

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

Encircle No. 240 on postpaid card



to a full blast. The Mortimore Controlled Air Nozzle makes it unnecessary to blow chips all over the place, thereby making a shop safer as well as cleaner.

The nozzle has only two working parts and is made without springs. It is fabricated of a strong, heat-treated aluminum alloy. The removable nose will take a ⅛ inch pipe thread extension. The unit weighs 5½ ounces, has a sturdy hook for hanging the gun. The complete cost of the air gun is $2.00 for a ⅜" line. A bushing is available for ¼" lines at an additional charge of 10c.

Mortimore Manufacturing Company, 72 Broadmere Road, Stratford, Conn. •

Use HANDY Postpaid Card, Circle No. 120

Precise Announces New Power Quill

A new heavy-duty power quill, the Precise Super 80, is the latest addition to its line of highspeed power quills by Precise Products Corp. The new many-purpose tool develops 1½ H.P. at the quill, according to the manufacturer, and provides a continuously variable speed range from 7000 to 25,000 RPM. A compact electric speed control with a simple dial permits easy selection of the speed desired. The control provides a Voltmeter calibrated in RPM, masterswitch, pilot light, and a fusetron for overload protection.

Precise Super 80 quill in internal grinding setup on lathe.

Standard equipment includes a super precision collet chuck with a capacity to ½". Also available is a solid quill extension accommodating wheels with up to ½" I.D. and 2½" O.D. Specially

VISUAL GRIND

TOP FIRMS SHOW

PROVED SAVINGS UP TO 75%

IN SET-UP AND GRINDING TIME WITH CONTINUOUS WORK INSPECTION AND INFINITE PRECISION

Working with TUNGSTEN CARBIDE, STAINLESS STEEL, STELLITE or TOOL STEELS—VISUAL GRIND will permit a semi-skilled operator to grind precision pieces without continued checking with the tool room—since this function is done by the built-in optical comparator. Fill in the coupon below—let us show you how VISUAL GRIND will speed production—cut costs.

Fill in this coupon NOW

VISUAL GRIND

THE CLEVELAND GRINDING MACH. CO.
1643 Eddy Road Cleveland 12, Ohio

Gentlemen:

☐ Please have your representative call at our plant. The most convenient time would be (week) .....

☐ Phone for appointment.

☐ Please send us complete information on the NEW VISUAL GRIND.

NAME..... TITLE.....

COMPANY .....

ADDRESS .....

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What's New

continued

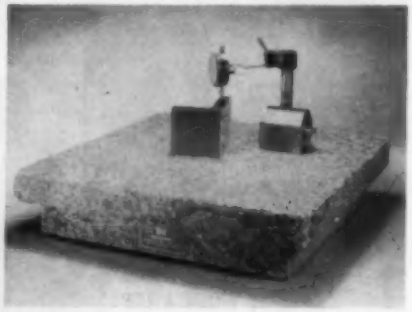
designed mounts, either universal or plane type, are offered by the manufacturer to permit easy mounting of the Super 80 to larger standard machine tools such as milling machines, tool and cutter grinders, lathes, surface grinders, etc., in either single or multiple operations. A high speed, universal motor, operated from standard 115V power supply, five grease sealed micro precision ball bearings, and a rigid accurate quill, all contained in a strong one-piece steel housing, permit milling, grinding or finishing to tolerances of .0001". A built-in filtration unit protects the micro precision bearings.

Precise Products Corp., Racine, Wis.

Use HANDY Postpaid Card. Circle No. 121

High Silica Content Granite Surface Plates

The Herman Stone Company of Dayton, Ohio, now produce a line of grey-granite surface plates with 70.70 silica content. True granite or acidic granite containing quartz is typified by this high silica content as contrasted



to softer diabase "granites" which have only 45 to 56 per cent silica content, lacking enough free silica to form quartz crystals. The presence of a high percentage of quartz in both Herman true grey and pink granite means extra hardness and natural relief areas which prevent sticking. Special lapping as required in diabase, for relief of wringing action, is eliminated. Herman granite is now available in unlimited supply and size. Plates are registered for accuracy to any required tolerance.

Use HANDY Postpaid Card. Circle No. 122

Industrial Oil-Hydraulic Reducing Valves with Pressure Adjustment Down to 25 psi

Two new low pressure type pressure reducing valves for industrial oil-hydraulic systems are now available from Vickers Incorporated. The new units feature a broad pressure adjustment range, are capable of providing any controlled reduced outlet pressure from 25 to 1000 psi.

Pressure reducing valves are used in industrial hydraulic systems to provide, for secondary circuits, controlled

maximum operating pressure. Such pressure reduction is frequently required to prevent possible damage to machinery or to a part being produced.

Both new valves are for use with ⅜-in. nominal pipe size in systems having operating pressures up to 2000 psi. Model XGL-03-B is a gasket mounted design; model XTL-03-B is provided with ⅜-in. pipe thread connections. Operation of these valves is such that reduced outlet pressure is maintained essentially constant, regardless of inlet pressure variations above the selected setting. Both models of the new valve are nominally rated at 8 gpm flow capacity.

Vickers, Inc., Box 302, Detroit 32, Mich.

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Attention!

ALL MANUFACTURERS OF MINIATURE PRECISION PARTS
for the following industries

AIRCRAFT INSTRUMENT & CONTROL
AUTOMATION COMMUNICATIONS
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ROYAL MASTER TG-12 CENTERLESS GRINDER
gives you Accuracy of .0002. Speed, and Economy

in the precision finishing of stems, shafts, gears, bearings and races, and many other miniaturized parts.

Finish-grinds diameters from .004" to 1½", in pure metal, alloys, plastics, and ceramics, producing 6-8 microfinish.

Priced so low that the small shop can afford one, and the large plant will use several.

Get all the facts.
Write today for our 6 page descriptive brochure.
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200 STATE HIGHWAY 23. RIVERDALE, N. J.

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WORKING WITH THE TOOL ENGINEER, the grinding foreman and the operator, the sales engineer is part of a team that can help cut costs and step up efficiency. Here author Tom McNeil, Action Diamond Tool's New England representative, discusses the proper wheel for the job with Jim Seversen, co-owner of Viking Tool Company, Shelton, Connecticut.

Here's a good way to solve . . .

Your Carbide Grinding Problem

Teamwork between the tool engineer and the sales engineer can often solve perplexing problems. Take the case of the carbide bits that wouldn't stay chucked—

by **Thomas A. McNeil**
Sales Engineer
Technical Abrasive Company

Grinding wheel manufacturers have had to solve the problems posed by modern carbide tool grinding practice, but sometimes a conference between the tool engineer and the wheel company sales engineer will clear up some of the knotty problems quickly.

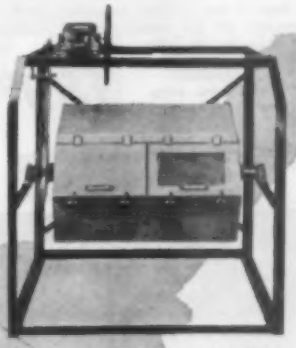
Take the problem that was facing Jim Seversen, tool engineer of the Viking Tool Company, Shelton, Connecticut. One of their carbide lines is a throw-away bit. The carbide forms were being gang-ground on a Blanchard grinder. The sides of the bits presented no grinding problem as they were held firmly in a fixture by screw pressure. But when the bits were nested in the grinder to grind the flat side, the bits were drawn out of the nesting fixture. Seversen discovered that the bits became magnetized by action of the metal bond of the diamond wheel used in the grinding operation. This magnetism overcame the down pull of the magnetic chuck, threw the work out of alignment and prevented further grinding. Since the metal-bond wheel did such a speedy and economical job on the carbide tips, Seversen was reluctant to switch to a resin-bond wheel. He called us in to help solve his problem. We didn't list any metal-bond "non-magnetic" diamond wheel in our catalog. So we referred the problem to the factory.

Based on the reports from both of us, the diamond wheel people tailor-

Your Key to **BETTER FINISHING**

Only **KRAMER's** Tumblers and Buffers give you SUCCESSFUL PRECISION FINISHING with high savings.

Yes! Kramer's Noiseless, chain-driven Tumblers CUTS DOWN YOUR LABOR COST . . . DEBURRS, DEFLASHES, POLISHES to give you the "PERFECT FINISH LOOK" desired to meet your highest standards.



SINGLE BARREL TUMBLER

Size: 30" x 36" or engineered to your specifications. Barrels lined with kiln-dried and glued maple. Child's play to operate. Economical on space as motors are individually mounted overhead—double decked or single. Tumbling supplies available also.

BUFFING LATHE

1 to 7½ H.P. Ball Bearing V-Belt Drive. Pre-determined speed set at factory or to your specifications. Buffing wheels and compounds available for every industry . . . Special compounds recommended for Special applications.

Write Dept. GF for Detailed Information

H. W. KRAMER CO.
120-30 JAMAICA AVENUE
RICHMOND HILL 18, N. Y.

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made some wheels out of non-ferrous metals, principally brass and aluminum. Put on trial at Viking, the wheels proved to be the answer to their problem.

A problem of this sort cannot be solved without the combined experience and cooperation of the tool and sales engineers. For no one can mastermind a wheel for a new job without this type of cooperation, a certain amount of on-the-job analysis, and a certain amount of trial and error.

Tungsten carbide itself is a variable in that it has a range of hardness from a very hard to a soft. To add to this difficulty, very often it is necessary to remove steel stock as well as the carbide tip. Very often this steel removal job for the sake of speed and economy must be done at the same time the carbide is being ground. Unless you know exactly what effect the various types of steel will have in combination with the tip, it can be a guessing game trying to hit the right wheel all the time.

Also influencing the choice of the wheel, of course, is the finish that is desired. It remains for the engineer to decide whether he wants to sacrifice finish for speed, or vice versa. Again this must be the subject for experimentation and cooperation between the sales engineer and the tool engineer.

The operator is also a factor that influences the efficiency of the wheel on the work. While this is more pertinent to off-hand grinding jobs, it can also be applied to production grinding. How the tools are set, how much of a cut the machine is set for on each pass and how the work itself is set up all effect the net result.

It is axiomatic to say that a sales engineer of a wheel manufacturer knows his own company's product and what it can do. But even that knowledge is not enough to prescribe the wheel for the job. Similarly, a tool engineer knows his machines, operators and the work. So just as a tool engineer cannot often order a wheel for a job from a catalog, neither can a wheel engineer prescribe the wheel from the catalog without seeing the work and problem.

Thus we see that there are specialists in various fields related to tool grinding and together they can solve grinding problems. But solving them has to be a joint operation, no matter how much each knows about his own field. • • •

WALLS TU-WAY BELT SANDER

USE IT EITHER WAY

Full 1/3 h.p. G. E. Motor

VERTICAL

At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

complete with cord, plug, switch ready to use $89.95

Illustrated Literature on Request
A few desirable distributor territories still available.

WALLS SALES CORPORATION
333 Nassau Avenue Brooklyn 22, N. Y.

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MISTKOP STOPS MIST

COLLECTS MIST-FOG EFFECTIVELY IN A SMALLER SPACE

This efficient Mistkop unit provides low-cost mist control for all machining operations employing coolants or lubricants. Requires no duct work or costly piping—*is actually portable!*

Mistkop is sturdy in design—has a minimum number of parts and gives long, trouble-free service. Stops clouding of lights . . . eliminates fire hazards of uncontrolled mist. Write for detailed description.

AGET Manufacturing Company
1380 Church Street • Adrian, Michigan

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Nth degree *precision . . . for less!*

SPITFIRE

Lapping Machines
For every lapping job!
Whatever your precision finishing requirements, Spitfire has the lapping machine custom designed for your piece parts, your production speed, your cost schedules. For unexcelled quality control at savings—contact Spitfire today!

The New
GYRO-MATIC "21"
Now . . . automatic flat lapping that saves time, money, work! Push button operation with many outstanding new features . . . produces optical flatness to .0000116!

"24" Flat Lapper
Low cost, super fine mechanical finishing. Lapping plate eliminates distortion.

"18" Flat Lapper
The scientifically designed features of Model "24" in a money-saving 18" lapping surface.

Cylindrical Lappers
Micro-inch lapping of plug gages, cylindrical parts, shoulders, etc. Closer tolerances in 1/3 the time!

Write today for complete details!

SPITFIRE Tool Co. 2931 N. Pulaski Rd. Chicago 41, Ill.

Encircle No. 245 on postpaid card

Automatic Feeder Handles Eye Bolts, Set Screws and Non-Symmetrical Parts

A new line of automatic feeders for eye bolts, set screws, thumb screws, hook bolts, studs, pins, specials and other headless or non-symmetrical headed parts has been announced by Automation Development Corporation, Willoughby, Ohio.

The machine illustrated is adjustable and tooled to handle 5 different eye

bolt sizes, on the same track, from ½" O.D. of the eye by 1" long overall length through 1" O.D. by 3" overall length. The machine can be modified to handle an overall length of 6".

The unit uses a vibratory feeder. Parts go down a track to an escapement that orients them shank first. The feeder is synchronized with the machine and operates in a speed range up through 75 pieces per minute.

Automation Development Corp., 38845 Mentor Ave., Willoughby, Ohio. •

Use HANDY Postpaid Card. Circle No. 124

Sheffield Electronic Internal Calibrating Master Adjustable Over 5" to 36" Range

Sheffield's new electronic Internal Calibrating Master is adjustable over a range from 5" to 36" and is available with a dual electronic amplification of either 1000/2000; 2500/5000; 5000/10,000 or 10,000/20,000 to 1. Amplification within each dual range on the Sheffield Accutron electronic amplifier can be switched from one to another without realignment of the indicating meter mechanism. The gage operates on 110 volt 60 cycle A. C., but readings are unaffected by line voltage fluctuations from 65 to 150 volts.

The range of adjustment is provided by a series of ⅝" dia. bars of different lengths that thread into the gage handle.

The gage is supplied as a complete kit in a box consisting of a gage handle

with plastic grip having an adjustable and interchangeable screw assembly on one end and an Electrojet transducer type pickup cartridge on the other, a second plastic grip to facilitate handling long assemblies, six length bars (1—1", 1—4", 1—2", 3—8") and the Accutron amplifier.

Sheffield Corp., Dayton 1, Ohio. •

Use HANDY Postpaid Card. Circle No. 125

Associations Encyclopedia

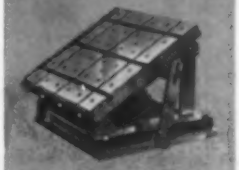
More than 5,000 associations, societies and chambers of commerce are listed in the ENCYCLOPEDIA OF AMERICAN ASSOCIATIONS, a business and reference directory, just published by Gale Research Company, 424 Book Tower, Detroit 26, Michigan, at $15.00.

Use HANDY Postpaid Card. Circle No. 126

1ST

Your First Choice FOR ANGULAR TOOLING.... ROBBINS!

"Magna-Sine" Magnetic Sine Plates for precision set-ups grinding single or compound angles.



Heavy Duty Sine Plates for angular machining. Wide variety of sizes. 12" square model shown.

Inspection Sine Plates for precision inspection and light machining on single or compound angles.

Simplify ANGULAR GRINDING

A look at the record shows exactly why Robbins equipment for angular tooling should be your first choice! Here's the record:

1ST to originate the idea of a simple sine plate for faster angular toolroom set-ups—1936

1ST to build these as a standard product for general distribution—1936

1ST to build a non-magnetic sine plate designed specifically for precision inspection —1946

1ST with a permanent magnet chuck—1948

1ST heavy duty sine plate for angular machining—1954

1ST and the only one with the exclusive "PERMA-FLAT" SWIVEL BLOCK—1956

Simplify ANGULAR MACHINING

Robbins is the only sine plate manufacturer with a complete line of sine plates for every angular set-up problem in precision machining, grinding and inspection. We also offer complete engineering and manufacturing facilities for the solution of special problems, and are now building high-production automatic assembly and other special machines. Send for sine plate literature, or send us details of your requirements in special machinery.

Simplify ANGULAR INSPECTION

OMER E. Robbins COMPANY

24800 PLYMOUTH ROAD DEPT. H DETROIT 39, MICH.

ALSO PRODUCERS OF SPECIAL MACHINERY, AUTOMATIC ASSEMBLY MACHINERY

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Ex-Cell-O's Part in New Atlantic Cable

Recent stories in the nation's newspapers, covering the late September opening of the first trans-Atlantic telephone cable, stress the technical problems encountered in the $42,000,000 undertaking. The new cable connects the U.S. with Europe.

One of these problems was the development of "repeaters," used to amplify the human voice along its 2000 miles of cable travel. The repeaters are spaced at forty-mile intervals and cost $75,000 apiece.

To enable the repeaters to withstand the great strains of cable laying and the terrific pressures at ocean bottoms, positive methods for protecting the costly devices were worked out by the designing engineers. As part of the protective armor, a series of steel rings were manufactured for the project by the Precision Parts Division of Ex-Cell-O Corporation, Detroit.

Two sizes were required—an inner and an outer ring. As assembled, the inner rings were placed end-to-end to sheath the repeater. The close-fitting outer rings were then slipped over the others to cover the joints. Mating diameters of the rings were held to .0004" total limit. Copper foil, jute and steel wire wrappings completed the watertight covering. ● ●

Check and Compare!

NO OTHER LINE OF BARREL FINISHING EQUIPMENT OFFERS SO MANY EXTRA FEATURES

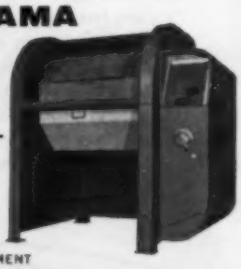
Take a minute . . . check SPEED-D-BURR *extra* features against your present finishing equipment—or compare with equipment you plan to install. No question about it . . . the total equals *more* dollar value when you buy—SPEED-D-BURR!!

36" x 32" BARREL UNIT

STANDARD EQUIPMENT	SPEED-D-BURR				
BARREL CAPACITY (Nearest comparable unit)	16.0	13.0	13.0	14.2 (Actual)	13.0
BARRELS (Rubber or Neoprene Lined)	Yes	Yes	Yes	Yes	Yes
HINGED BARREL DOOR (Speeds open and close time 50%)	Yes	No	No	No	No
QUICK ACTING CAM LOCKS (Opened without tools)	Yes	Yes	Yes	Yes	No
MODERN, STREAMLINED CABINET	Yes	Yes	Yes	No	No
CABINET PANELS Extra heavy gauge steel-integral part of supporting member (not light sheet metal wrapper)	Yes	No	No	No	No
OSLON ENGINEERED CABINET (For safe and fatigueless operation)	Yes	No	No	No	No
MOTOR SIDEMOUNTED AND COVERED FOR PROTECTION	Yes	No	Yes	No	No
VARI-SPEED MOTOR	Yes	No	No	No	No
LOW VOLTAGE CONTROLS RECESSED AND SIDE MOUNTED FOR SAFETY	Yes	No	Yes	No	No
PRESET STOP AND START TIMER	Yes	No	No	No	No
DIRECT READING TACHOMETER	Yes	No	Yes	No	No
POSITIVE STATIC BRAKE	Yes	No	No	No	No

TOTAL = More dollar value with SPEED-D-BURR!

THE **FUTURAMA** SERIES
Custom Styled for **MODERN INDUSTRY**



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MT-82

THE WORLD'S MOST COMPLETE LINE OF PRECISION BARREL FINISHING EQUIPMENT & SUPPLIES

Write for catalogs on:
SPACE MISER
FUTURAMA LINE
MITY-MITE LINE
HANDLING EQUIPMENT
MEDIA AND COMPOUNDS

Service is our most important product . . . Use it!

SPEED-D-BURR CORPORATION
3613-A San Fernando Road, Glendale 4, Calif.

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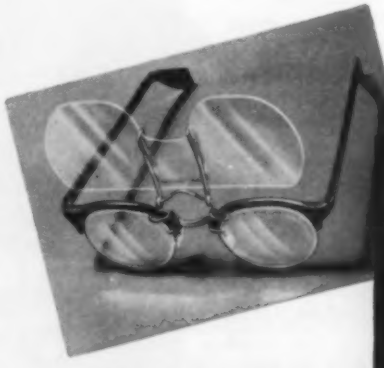

"KIM CLIP"

THE HANDY WAY TO GLARE PROOF PROTECTION

KIM-CLIP is a simply designed spring clip which holds melter's spectacles or plastic protective shields for welding and grinding operations. KIM-CLIP fits all types and makes of spectacles and can be attached in seconds. Adjustable to three definite positions: Up, OUT or Down. Extremely light weight and inexpensive too.

Kimball SAFETY PRODUCTS COMPANY
9310 Wade Park Avenue • Cleveland 6, Ohio

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Free Catalogs and Bulletins

To receive your copy of any of the literature listed here use the post-paid card opposite page 48. Just circle the proper number on the card and mail it. We'll do the rest.

Multiple-Head Conveyor-Type Belt Grinders

A new 4-page bulletin describes various models of multiple-head abrasive belt grinders, manufactured by Engelberg Huller Company, Syracuse, New York. Illustrated machines are designed for high-volume flat surfacing or ferrous and non-ferrous metals, glass, plastics, ceramics and other materials. Included in the two-color bulletin are: photographs, with complete specifications, of one-, two-, four-, and five-head models; two-side model for surfacing of both sides of flat parts; production and operational photos; and illustrations of processed parts, with data on abrasive belts, tolerances, and production rates.

Engelberg Huller Company, Inc., 831 W. Fayette Street, Syracuse 4, N.Y.

Use HANDY Postpaid Card. Circle No. 1

Surface Grinder

Bulletin describes new Reid Brothers Model 824 surface grinder just introduced. Having a table 8 x 24 inches, the machine has a capacity of 15 inches from table to wheel. Machine features full power controls of all grinder adjustments, to meet production grinding requirements. Table is powered by rubber timing belt, with variable traverse up to 75 feet per minute.

Reid Brothers Co., Inc., Beverly, Mass.

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Reid Model 824 Surface Grinder

Descaling Steel Mill Products

"Steel Mill Cleaning News" has been published by Wheelabrator Corporation. Dealing with the mechanical blast descaling process, the bulletin covers descaling of hot rolled steel sheet and strip, slabs and billets, and plate. It also deals with the conditioning of ingot molds, dressing of mill rolls, and cleaning of structurals prior to the application of surface coatings. The illustrated publication contains almost a dozen case histories taken both from mills and from users' plants.

Wheelabrator Corp., 1169 South Byrkit St., Mishawaka, Ind.

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Cutter Grinder

Quickset Model E cutter grinder is described in 4-page bulletin. Machine is cam-controlled for helix and OD grinding, taper grinding, end and side tooth grinding, or left-hand grinding. Clearance angles are quickly obtained by use of cams and reference chart. Grinding capacity is 4-in. OD x 7-in. long.

Crosby Machine Tool Co., 4916 San Fernando Rd., Glendale 4, Calif.

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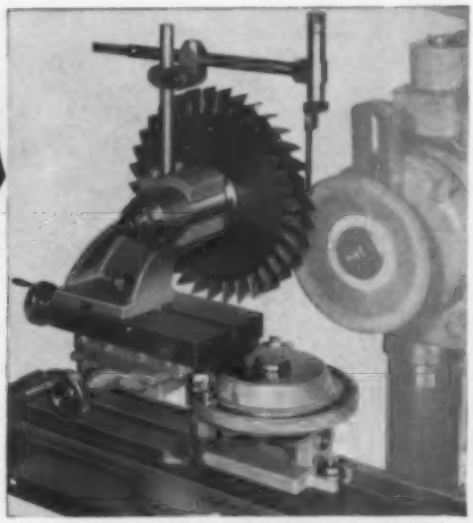
THE UNIVERSAL RADIAL CUTTER GRINDING FIXTURE

Does 5 Operations without removing cutter from its ARBOR!

On cutters up to 8" in diameter, the No. 6 fixture, as shown with our No. 6A heavy-duty, right-angle, ballbearing spindle workhead:
Sharpens side teeth on **both** sides.
Sharpens peripheral teeth.
Generates small or large radii on **both** corners of each tooth.
(Other workheads available)



▲ THESE DEPENDABLE GRINDING FIXTURES SAVE THE LIFE OF YOUR CUTTERS. Write for our catalog 603

◀ UNIT 1A
This Universal Cutter Grinding Fixture fits any universal tool or surface grinder.

Radial Grinding Attachment D combines with Unit 1A for sharpening end mills with square, conical, or ball nose shapes. ▼

▲ UNIT 4A
Radial Grinding Fixture for sharpening fluted end mills with square, conical, or ball-nose mills. The index disc provides for multi-flute cutters.

▲ NEW FINE-ADJUSTMENT SLIDING SWIVEL GIVES SMOOTH, PRECISE INDICATOR SETTING. Smooth, positive positioning of finest dial indicator is readily accomplished by the fine-adjustment Sliding Swivel. Final precise positioning is accurately made by slight movement of convenient lever "A".
WRITE FOR:
SLIDING SWIVEL FOLDER

ROCHELEAU TOOL & DIE CO.
650 North Main St., Leominster 1, Mass.

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Free Literature

continued

Grinding Lubricants

Comprehensive loose-leaf catalog now available from White & Bagley contains valuable information on the various W & B grinding lubricants for a wide range of work. It offers help in selecting the proper lubricant whether paste-form, straight oil, water-soluble or base. Page on W & B Bases includes blending chart covering various metals and operations.

The White & Bagley Co., P.O. Box 1171, Worcester 1, Mass.

Use HANDY Postpaid Card. Circle No. 5

Non-Inflammable Solvent

An illustrated twelve page booklet describes Immunol, a non-alkaline, non-acid detergent and rust preventive that cleans, degreases and rustproofs metal in one operation. The booklet tells how solvent eliminates the fire hazard; replaces other soaps, alkalies and solvents; eliminates problems of dermatitis, toxicity and skin irritations. The product can be applied by wiping, dipping or spraying, and is said to mix with hot or cold, hard or soft water.

Harry Miller Corp., 4th & Bristol Streets, Philadelphia 40, Pa.

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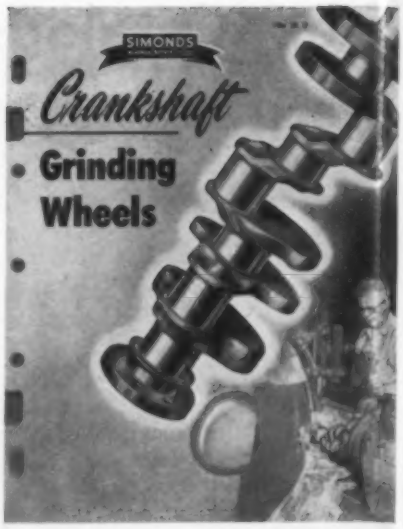

Crankshaft Grinding Wheels

Simonds Abrasive Co. has issued a new catalog bulletin ESA-263 about crankshaft grinding wheels for production use in automotive type engine plants. Special information is included for multiple spindle set-ups for grinding main or line bearings, and for single wheel set-ups for pin bearings. Also included is data on regrinding automotive crankshafts in the automotive service trade and production grinding wheel specifications for camshaft grinding.

Simonds Abrasive Co., Tacony and Fraley Sts., Phila. 37, Penna.

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Leveling Jacks

Enterprise Machine Parts Corp. offer a new bulletin on their expanded line of machine leveling jacks. Bulletin provides complete information on available models, sizes and capacities, together with data on reducing vibration in machine tool set-ups. Marketed under the name of Empco, the leveling jacks provide dependable support and positive leveling adjustment for production machines, tool room equipment, special machinery, industrial furnaces, large surface plates, assembly fixtures, etc.

Enterprise Machine Parts Corporation, 2731 Jerome at McNichols Road, Detroit 12, Michigan.

Use HANDY Postpaid Card. Circle No. 8

Precision Brush Finishing

Getting double duty from centerless grinding machines is explained in a four-page leaflet which contains a brush specifications chart. It tells how to reduce down-time on centerless grinders by extending their use to precision brush finishing on cylindrical parts. Types of finishing possible and characteristics of brushes needed are described.

The Osborn Mfg. Co., Cleveland, O.

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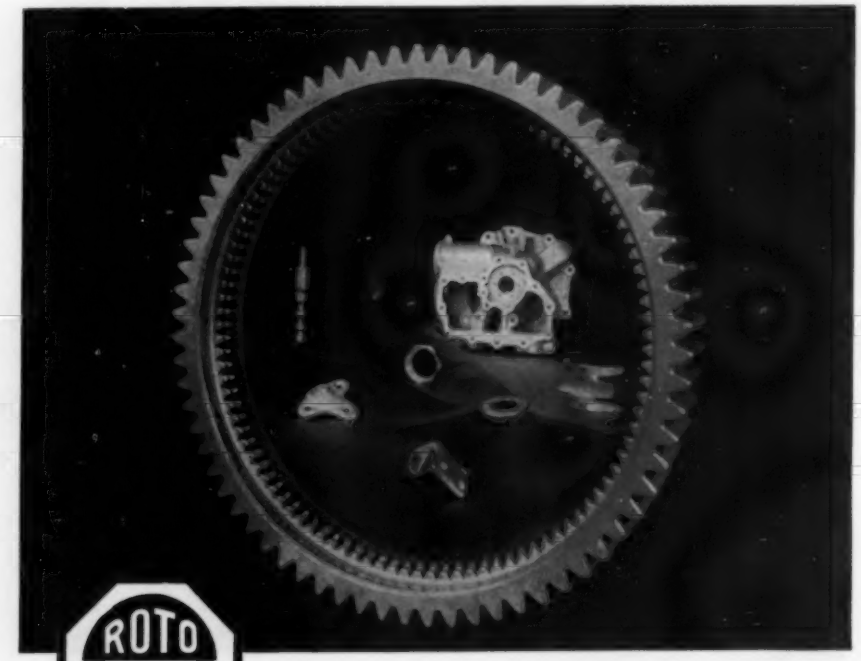

ROTO FINISH

it's the finish that counts!

Roto-Finish maintains exact tolerances on precision parts with no significant dimensional changes. It makes possible a wide range of finishes applicable to parts of almost any size or shape; finishes a variety of materials — at big savings in manpower and costs. Without obligation, send sample unfinished parts to us. Include finished part for guide and your specifications. Roto-Finish will finish parts in its laboratory. You get a complete process report. You are guaranteed results and a finish that counts!

WRITE FOR FACT-PACKED ROTO-FINISH CATALOG NOW

Roto-Finish COMPANY

3730 Milham Road, Kalamazoo, Michigan
Originators of the Roto-Finish Process

P.O. Box 988
Phone FI 3-5578

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Mechanical Comparator

Pratt & Whitney Sigmatic mechanical comparator is a moderately-priced self-contained instrument designed for close tolerance inspection. Eight-page circular describes features and operation of comparator, which offers repeatability on the higher magnification models to millionths of an inch. Flush pointer eliminates reading errors due to parallax. Over-run design prevents damage to mechanism if oversize parts are presented to the gage.

Pratt & Whitney Co., Inc., Charter Oak Blvd., West Hartford 1, Conn.

Use HANDY Postpaid Card. Circle No. 10

Barrel Finishing Catalogs

"How to Reduce Production Costs 80% or More" shows how this savings can be made and presents representative units of the various equipment lines. "Futurama Line" pictures the streamlined, custom-styled Futurama equipment, most adaptable to high production needs. "Mity-Mite Line" offers a unit for every size plant. "Media and Compounds" shows a wide variety of grades, grits and sizes. Slip sheets covering handling equipment and other special units are also offered.

Speed-D-Burr Corp., 3613 San Fernando Rd., Glendale, Calif.

Use HANDY Postpaid Card. Circle No. 11

"We got to put it in production. The Old Man's eight-year-old designed it all by himself."

4-Inch Concentric Grinder

A new catalog is available describing the Landis 4" concentric grinder. This is a shoe-type centerless grinding method for ring-shaped parts such as bearing races with either straight or profiled shapes. O. D. grinding of small parts with accuracy is made possible by a new concept in work holding developed by Landis, which uses a magnetic face plate on the headstock spindle. Machine may be equipped for automatic loading, power dressing.

Landis Tool Co., Waynesboro, Penn.

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Landis 4" concentric grinder.

PEERLESS WIDE BELT SURFACER . . .
for wood, plastic and metal

In addition to centerless machines, Production Machine Company also makes the famous Peerless Abrasive Belt Surfacers.

Of heavy duty construction throughout, these machines are built to operate continuously on all types of platen grinding, sanding, and surfacing jobs using abrasive belts. Available in vertical type as illustrated with work table and miter gauge adjustable for angles to 45°. Horizontal type has moveable work stop and may be adjusted to any position on the platen.

Made in three sizes for belts 9", 14", or 20" wide. Write for bulletin with full specifications. Dept. F.

PRODUCTION MACHINE CO., Greenfield, Mass., U.S.A.

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Free Literature

continued

Pneumatic Symbols, Template Guide

This booklet lists all JIC symbols for pneumatic valve controls and is packaged with a drafting template guide. Simplified drawings in each category may be used to designate the pneumatic equipment of any manufacturer, and the template guide is an aid in drafting the desired symbols. Further assistance is provided by the coding system in the booklet, which keys each of the symbols to the guide code and to the Ross catalog number.

Price one dollar. Ross Operating Valve Co., 120 E. Golden Gate Rd., Detroit 3, Mich.

Use HANDY Postpaid Card. Circle No. 13

Gages

Catalog No. IPC-6-56 contains the principles of air gaging with the column Precisionaire. Features basic tooling for inspecting internal and external dimensions and conditions, and types and sizes of adjustable air-gage tooling.

The Sheffield Corp., Div. 610, Dayton 1, O.

Use HANDY Postpaid Card. Circle No. 14

Universal Grinding Head

A grinding head with universal motion in an infinite number of directions provides operating versatility, can be used for complete sharpening of most cutting tools. Claimed to eliminate elaborate setups, save time, cut costs.

Folder available from Spiral Step Tool Co., 5400 N. Damen Ave., Chicago 25.

Use HANDY Postpaid Card. Circle No. 15

Barrel Finishing Equipment

This loose-leaf catalog presents and illustrates the Johnny and Johnny Jr. barrel finishing machines; barrels for both models; other barrel finishing machines, including one submerged type; handling equipment; Recip-O-Rator.

Ultra Sheen Div. of B. W. McIntyre Co., Reseda, Calif.

Use HANDY Postpaid Card. Circle No. 16

Wheel Dressers

Literature is available which pictures six types of wheel dressers, plus spindle unit mounting studs. Holders for all types of grinders.

Aer-O-Matic Tool Co., 5059 W. Diversey, Chicago 39, Ill.

Use HANDY Postpaid Card. Circle No. 17

Abrasive Cutting Principles

"Principles of Abrasive Cutting, Its Development and Application" traces the history of abrasive cutting from prehistoric times. Booklet has been prepared to explain the Campbell abrasive cutting method and illustrate the machines which perform this process.

Campbell Machine Div., American Chain & Cable Co., Inc., Bridgeport, Conn.

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to do small grinding jobs

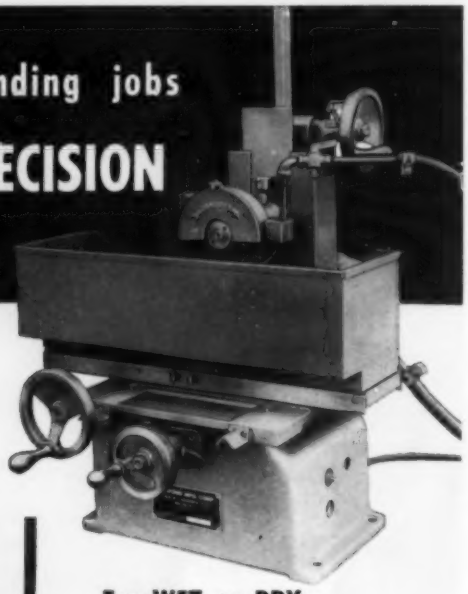
to MICRO-PRECISION

FAST...

you need the

SANFORD Model SG

SURFACE GRINDER



This unrivalled small parts grinder can be depended upon for micro accuracy. It's easy to use too . . . every hand wheel and operating switch is at your finger tips.

Designed and built by engineers and tool makers of rare foresight for tool, die and gage work, it has been constantly preferred after these many years of proven worth.

Write for fully illustrated literature, replacement parts and special attachments data with price list.

For WET or DRY grinding, specify optional equipment.

PARTIAL SPECIFICATIONS —

Chuck Surface—3"x5" or 4"x6".
Table travel — 8", traverse 4".
Vertical head movement — 6".
Work area under 4" wheel — 6", with chuck — 4".
Standard grinding wheel — 4" x ⅜" x ½".
Spindle speed—approx. 5500 RPM.
Motor, 1/6 HP, single or 3 ph., dynamically balanced.
Dimensions—23"x30"x27" high.
Net wt. approx. 160 lbs.

Representatives in major industrial areas

SANFORD MANUFACTURING CORP.
1026G Commerce Ave., Union, N. J.

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"He must've come with that last shipment of diamonds from Africa."

A STEAL

Divine Bros. 4 Stage Automatic Polishing & Buffing Machine, equipped with 4 Heads—20 H.P. each with 45 ft. conveyor. Heads can be removed and used separately. Ideal for polishing of strip, moulding, hardware, bumpers, iron parts, etc. Has seen little use. Original cost over $18,000. Will sacrifice to first offer of $3000.00. Photos available.

STAFFORD MFG. CO., INC.
145 - 58th St. Brooklyn 20, New York
HY 2-8000

News of the Industry

Norton Announces Reorganization

Norton Company has created three new divisions in a reorganization effective September 17. In making this announcement, President Milton P. Higgins said, "Norton Company has now grown to a point where it is necessary to broaden the base of responsibility for the operation of the company. It is our firm intention to leave an increasing amount of responsibility in the hands of the division managers."

The three new divisions are the Abrasive Division, headed by **John Jeppson** as vice president and general manager, the Refractories Division with **William G. Fallon** as general manager, and the Electro-Chemical Division, headed by **Howard J. Daley** as vice president and general manager.

This brings the number of divisions within the company to six. The others, which are not affected by the change,

John Jeppson

are the Grinding Machine Division, Behr-Manning Division (located at Troy, New York) and Norton Behr-Manning Overseas, Inc., which handles export sales and operation of overseas plants.

Although the terms "abrasive division" and "refractories division" have been used loosely within the company for many years, this is the first time they have been organized along true divisional lines with a general manager in charge.

New Posts

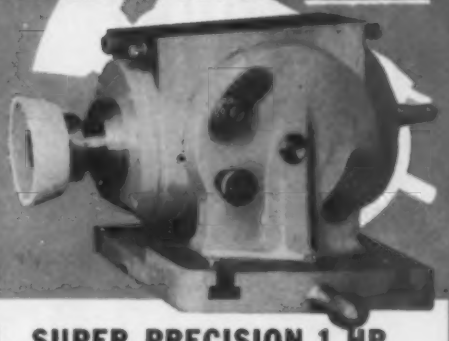
As a result of this organizational change, two other posts have been created.

Ralph M. Johnson, formerly vice president in charge of sales of abrasive and refractory products, becomes vice president and director of sales. His will be the responsibility for giving functional guidance to the general managers of the three new divisions with respect to sales policies, methods of distribution, distributor policies and selections, training of sales personnel, sales promotion, prices and pricing methods.

Mr. Jeppson also becomes vice president and director of manufacturing. He will be responsible for giving functional guidance in the field of production to the general managers of the

HERE'S A HEAD THAT TILTS

and Yours Will Nod, Too When You See What You Can Do With This One

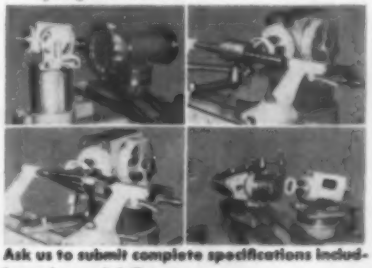


POPE SUPER PRECISION 1 HP, 3600 RPM MOTORIZED TOOL AND CUTTER GRINDER CLEARANCE ANGLE SWIVELLING HEAD

With Angular Adjustment In A Vertical Plane

Give this versatile head the nod and save time and money these seven ways:

1. You can use cup wheels for practically all clearance angles and thus produce a cutting edge on tools that lasts longer because it is stronger.
2. You can keep the tooth rest on the center line of the cutter for practically all grinding on centers or in the work head.
3. You can grind most cutters and reamers all over with a single set-up using the swivelling table and Pope tilting head.
4. You can read all clearance angles directly in degrees from the scale provided on the head. No more mistakes.
5. You can get the right clearance angle on such tough grinding jobs as slab mills, taper reamers, angular cutters and form tools.
6. You have one safe speed — 3600 RPM — for all wheels generally used on cutter grinders. Heat checking of cutters is virtually eliminated.
7. You have a head that's so easy to adjust and use it saves you time and money every time you grind a tool.



Ask us to submit complete specifications including price and delivery.

No. 101

Specify POPE PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET • HAVERHILL, MASSACHUSETTS

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continued

other two new divisions. In this capacity, he will have continuing responsibility for the plants engineering, industrial engineering and quality control departments. All these appointees will report to Ralph F. Gow, executive vice president.

The Abrasive Division will have the responsibility for the production and sale of abrasives, both crude and finished; grinding wheels; and other bonded products for abrasive uses. The newly opened grinding wheel plant at Santa Clara, California will be part of this division.

Mr. Jeppson, 39, is the grandson of one of the founders of the company. He began his business career at the Worcester plant in 1940 following graduation from Amherst College. In 1948 he became the first superintendent of Plant 7, Norton's newest Worcester grinding wheel manufacturing plant. In that same year, he was elected to the board of directors. He was elected a vice president in 1953.

Prior to his present appointments, Mr. Jeppson was vice president in charge of the manufacture of all abrasive and refractory products. •

Cincinnati Milling Products Div. Appointments

Philip O. Geier, Jr. has been appointed to the new position of Assistant Manager and Harold W. Cottrell to Sales Manager of the Cincinnati Milling Products Division, Cincinnati Milling & Grinding Machines, Inc.

Mr. Geier, who has been Sales Manager for the past two years, has been with Cincinnati Milling for over 17 years. Mr. Cottrell became associated with Cincinnati Milling in 1936.

The Cincinnati Milling Products Division manufactures Cimcool Cutting Fluids and Cincinnati "PD" Grinding Wheels.

Philip O. Geier, Jr.

Harold W. Cottrell

BLOHM
HORIZONTAL
SURFACE GRINDERS*
You'll be Amazed...
at the high quality job you can do with BLOHM's new line of horizontal surface grinders . . and even more amazed at the extremely low cost!
Cross movement by the table assures maximum precision and accuracy. Powerful heavy-duty 5 hp motor mounted directly on spindle operating on adjustable oilmatic bushings – pressure lubrication – Use wheels up to 4" with cross feed up to 2½" per stroke – These features, plus the unusually sturdy overall construction, eliminate virtually all vibration and insure maximum concentricity. Exclusive BLOHM MICROTIP in-feed and depth-feed control permits automatic finger-tip adjustment up to .0002" on cross feed and .0004" in depth feed
PRODUCTION
PRECISION
PRICE
MASERATI
MILLBURY NEW YORK
Write, Wire or Phone for detailed descriptive literature.

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Executive Appointments at Gear Grinding

Three major executive appointments have been announced by Gear Grinding Machine Company.

William F. Wilson has been named executive vice president of Gear Grinding; **Wiliam J. Taylor** is the new vice president and general manager of Republic Gear Co.; and **Fred F. Miller** is now vice president of Detroit Bevel Gear Co.

All are in their early forties. In announcing the appointments, Gear Grinding President Edgar D. Leon said the company's policy of investing authority and responsibility in young men has been demonstrated in the nominations.

William F. Wilson

The presidency of Republic will be left open temporarily, Leon said, and Taylor will run that subsidiary through his new position. The resignation of Herbert S. Ries created the vacancy.

Wilson formerly was vice president in charge of engineering and manufacturing at the parent company. He has been with Gear Grinding for 3½ years.

Taylor moves into Republic from Detroit Bevel, where he served 11 years. He had been vice president, administration, for the past 18 months.

Miller, a 22-year veteran with Gear Grinding and Detroit Bevel, has been vice president of operations and director of engineering at Detroit Bevel. He began in the shop at Gear Grinding and has worked in practically every phase of the operations. •

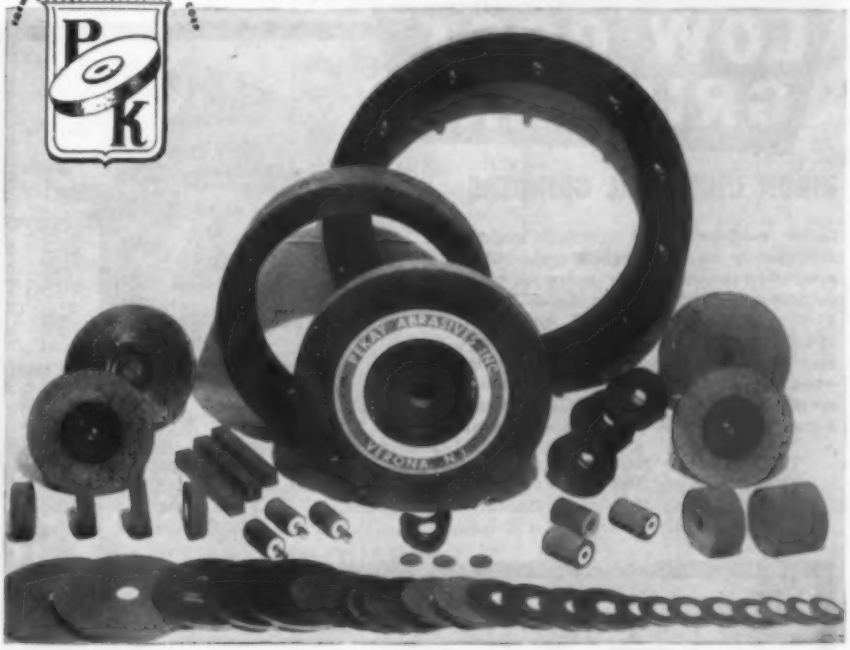
Edward V. Schuerer has been named district representative in the state of Wisconsin and the upper peninsula of Michigan for Torit Manufacturing Co., St. Paul, and will be responsible for the sales and service of Torit unitized dust collection equipment in this area.

Bay State Appoints Deneau

James D. Deneau has been promoted to Michigan District Account Executive for Bay State Abrasive Products Company, Westboro, Mass. This is a new position effective October 1, it was announced by S. Gordon Saunders, manager of the Bay State's branch office located at 25600 Princeton Road, Inkster, Michigan.

Mr. Deneau has been an abrasive engineer for Bay State in the Detroit area since 1948.

A complete line of custom Abrasives



Are you grinding with 1957 model grinding wheels or just letting the old "model burner" do?

Let us show you what real wheel development is. For example, a flexible rubber bonded wheel that operates safely at 16,000 f.p.m.

Let Pekay show you the way.

Send For Complete Information.

PEKAY ABRASIVES, INC.

271 GROVE AVENUE VERONA, NEW JERSEY

CENTER 9-4600-1

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Industry Observer

Detroit Free Press reports that Kaydon Engineering Corp., Muskegon, Mich., makers of precision thin-section bearings, has come out with a "gage and feed" system for centerless grinders claimed to eliminate manual gaging, give faster production, better wheel life. Called "Size-O-Tron."

Sales of optical comparators have zoomed in the past twelve months, according to makers of such equipment. They attribute increase to demand for closer inspection and control of fine-tolerance work. Entrance of a new producer in the field this year is proof enough of growing use of optical comparators.

G & F editor Bill Schleicher is on a tour through West Germany to observe its booming postwar economy which has captured so much of the world's capital-goods market. We hope to have a report on Bill's trip in our December issue.

Behr-Manning's Metal Finishing Show in Cleveland is sure to turn up some new and interesting applications of coated abrasives, as well as new machines to use them. We'll have a full report on the show in December.

Look for an announcement from a major surface grinder builder of a grinder with electronic control of table travel limits and table speed, using simply-operated knobs for both functions.

There are some mighty interesting titles in the new list of films on machining available from members of the National Machine Tool Builders' Association. It will pay you to check the NMTBA catalog for the films you haven't seen—many of them will be useful in training programs, etc. Copies of the 24-page catalog are available from the National Machine Tool Builders' Association, 2071 East 102nd St., Cleveland 6, Ohio. Requests for individual films are made directly to member companies.

Use of static-type electronic controls for repetitive machine cycles is on increase. Springfield Machine Tool Co., which used Westinghouse Cypak controls for two grinders delivered to Ford over a year ago, reports satisfactory operation of the units, will deliver two similarly equipped grinders to Chevrolet Toledo. G & F will have a full report on the use of Cypak for grinder control soon.

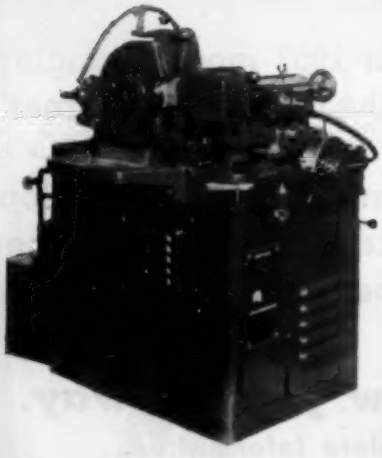
Automatic wheelguard dressers are being seen in more shops than ever these days, even for straight dressing jobs. Reason for their use is that they give a dependable dressing time for accurate estimating, and that they do a better job of dressing, with longer diamond life, better results as far as the face of the wheel are concerned.

LOW COST GRINDERS

RIBON UNIVERSAL GRINDERS

Electro mechanical and hydraulic models produced by one of Europe's largest grinder manufacturers—completely universal with swinging internal grinding heads. 14"x 2"x5" O.D. wheel with 3 H.P. and 18000 and 35000 I.D. spindles with 1½ H.P. Long conical adjustable plain bearings in both wheelhead and workhead with automatic pressure oil bath lubrication. All machines have automatic table traverse and infeeds.

11"x20" Electro Mechanical Grinder	$3450.00 fob N.Y. or Chgo.
11"x32" Electro Mechanical Grinder	$3600.00 fob N.Y. or Chgo.
11"x42" Electro Mechanical Grinder	$3850.00 fob N.Y. or Chgo.
12"x20" Hydraulic Plunge Cut Grinder	$5950.00 fob N.Y. or Chgo.



CENTRI CENTERLESS GRINDERS

Close tolerance production units capable of .0001" tolerances in production. Long conical adjustable plain bearings on both grinding wheel and feed wheel spindles with pressure oil bath lubrication. Equipped for bar feed, thru feed, and infeed work with automatic ejectors and automatic cycling on infeed where desired. Diamond or crush dressing on both wheels with contour form and taper dressing of wheels by either hand feed screw or hydraulically.

MODEL 0 Work diameters .012"-½" ($1950.00 fob N.Y. or Chgo.) 10x2½x5 wheel with 2½ H.P.

MODEL 1 Work diameters .016"-2" ($3450.00) 12x4x5 wheel with 7½ H.P.

MODEL 3 Work diameter .030"-3" 16x8x5 wheel with 16 H.P. Hydraulic Dressing of wheels and hydraulic automatic Variable cycling for infeed ($6475.00)

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1801 W. COLUMBIA AVE. CHICAGO, ILLINOIS

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"Boy, that's punching it, Ralph!"

GRINDING Safely

by **Edmund Mottershead,** President
Mottershead Associates, Chicago

Safe and productive grinding depends to a large degree on the condition of the wheels used, and this in turn depends on how the wheels are handled and stored. Proper storage facilities for grinding wheels must keep the wheels dry, at a reasonably constant temperature, properly and adequately secured against rolling, protected from falling objects or trucks moving through the plant, cushioned when stacked one upon another, and supported free from bending strains.

DO'S

1. DO provide proper racks, bins, or drawers for storing various types of wheels.
2. DO store straight and tapered wheels on edge in racks with two-point cradle support, and partitions separating individual wheels.
3. DO use flat shelf for storing thin wheels with organic bond, laying them flat to prevent possible warping.
4. DO stack cylinder wheels and large straight cup wheels with corrugated card cushions between the flat sides, or in the same type racks used for storing large straight wheels.
5. DO stack large flaring cup wheels on a flat shelf face to face and base to base.
6. DO use bins or boxes to store internal wheels, cups, and other small size wheels or points.

DON'TS

1. DON'T handle wheels carelessly. This causes wheel breakage. Grinding wheels break relatively easily.
2. DON'T drop or bump wheels against each other or against other objects.
3. DON'T roll abrasive wheels like a hoop.
4. DON'T pile heavy objects on top of wheels. Treat them as you would any other fine tool.
5. DON'T store wheels in damp, or where there are extremes of heat or cold.
6. DON'T store thin wheels on their edge. They may warp, become unfit and unsafe to use.

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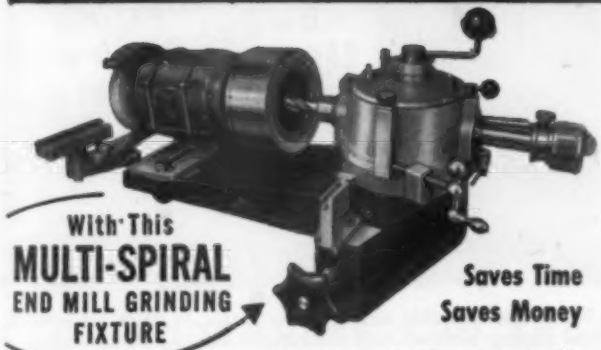
Quickly, Completely, In Your Own Shop



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MULTI-SPIRAL
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Saves Time
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- Simple to operate
- Finish-grind spiral lips and end in one operation.
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- Do "Radial Relief" by grinding inside the wheel.
- One million different leads, right and left hand.

Enables you to sharpen end mills quickly, expertly, in your own shop. The Head can be detached and used on cutter-grinders, surface-grinders and milling machines for various types of spiral grinding or milling, such as flute grinding, web thinning, tap grinding, step grinding and form relief grinding for end cutting. Send for details now!

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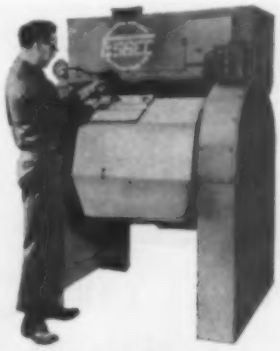

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never need babying, even on the toughest jobs. You can count on uninterrupted production, long life and low upkeep. They're truly heavy-duty, with extra-rigid welded-steel drums, oversize self-aligning bearings, plus power to spare. They give higher production rates with their low loading heights, large unobstructed door openings, quick-locking safety doors, and safe accessible controls.

All ESBEC barrel finishing equipment offers practical, profit-producing features based on first-hand experience in our own, and other finishing plants. **Write for catalog today!**

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REVOLVES WITH WHEEL

MAXIMUM STRENGTH AND SAFETY — Allows Full View of Work

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C-5B	5 3¾	4.80	
C-4	4 3	4.70	
CS-6	6	4.90	STRAIGHT CUP
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Adaptor for straight bushed wheel — list price $4.75

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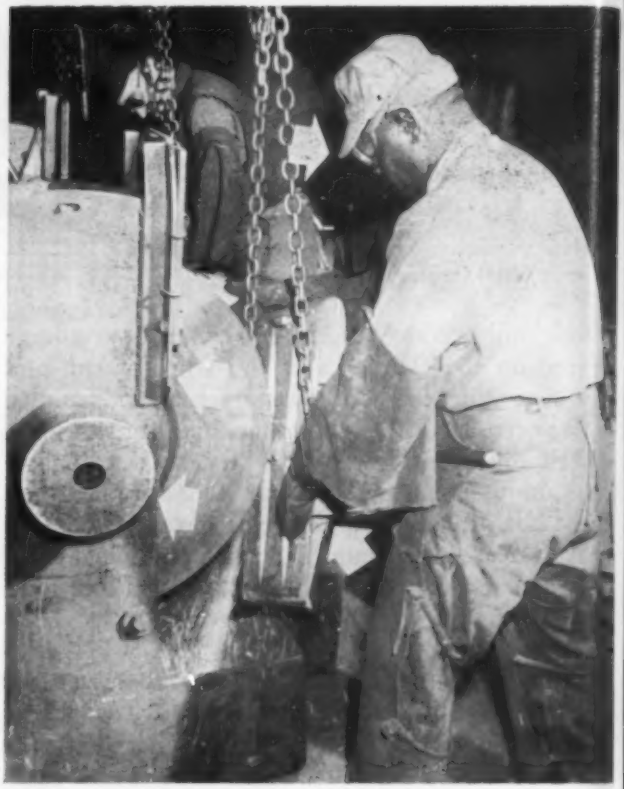

High production snagging of heavy castings is a safe job when performed correctly. With wheels properly balanced and with guard flaps down to within ¼ inch of wheel face, operator is adequately protected with goggles and heavy protective garments on fast-paced foundry job.

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NEW TURNTABLE DOWN-DRAFT dust collecting benches by WOLVERINE

Type BT

Revolving turntable allows the operator to work all around the casting without stop for re-positioning . . . an addition to the standard Wolverine rectangular benches — Provides: • Better dust collection due to higher velocity. • New design, permitting exhaust outdoors where required, or return to room if desired. • Standard velocity, 300 feet per minute, and, if application requires, higher velocities available up to 800 feet per minute. • Ideal system for collecting dust from grinding, polishing and sanding operations.

Heavy duty industrial viscous filters in rear compartment remove dust from air stream and axial flow fan in top of rear compartment discharges vertically back into the room or outdoors if required.

Dept. G

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Snagging castings with a floor stand grinder is hard, fast, rough work calling for a high degree of coordination on the part of the operator. Heavy castings such as these must be hung on their center of gravity to hold the weight. Operator wears goggles, heavy gloves and other protective clothing.

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Ball bearings eliminate drag . . . Increase grinder life . . . Reduce burning hazard . . . More pieces produced per grinding . . . True balance assures greater safety. Return dresser for reconditioning . . . new tool guarantee. Unit is interchangeable with all our holders. Special dressers made to order to fit any machine. Complete line of "Place" dressing tools manufactured, dating back to 1917 . . . Write for complete catalog.

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". . . . removed sink-welds in one-third time with your belt unit against discs. Cost 1⅓¢ per sink against 4⅔¢..."

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This adaptable tool is a "must" in every shop: It is fast, accurate and as handy as a third arm. Get full details, without obligation, by writing for new Bulletins No. 104 and No. 105 . . . showing full specs and many uses to which the 6-72 Belt Unit has been put.

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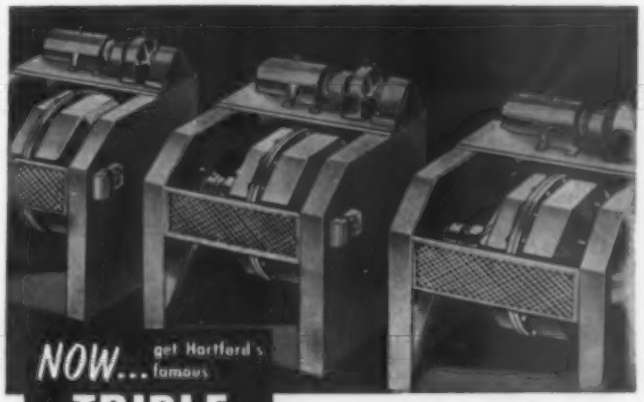

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Compare these advantages! The Hartford fully enclosed Model 1956 is extremely compact . . . requires less floor space than most enclosed barrels. With Hartford the power unit is on top, where it belongs for long life, cleanliness and ease of maintenance. Barrel is mounted on rugged "A" frame for maximum strength. Streamlined steel enclosure confines splash and contributes to safe operation. Pivoted front guard opens to permit quick, easy loading and unloading . . . plus easy removal of barrel assembly. Standard power unit has four speed gear shift transmission. Literature and prices promptly furnished.

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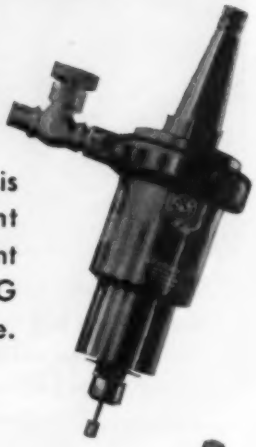
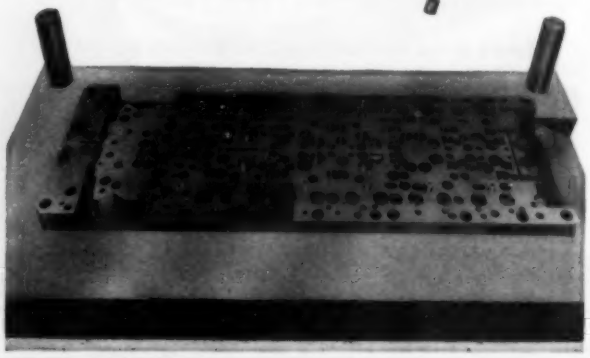
HOLES JIG GROUND with *Vulcanaire*



Provide yourself with this inexpensive* instrument for use on your present equipment and JIG GRIND with a guarantee.



A seven station die from Vulcan's contract Tool Room (Your Tool Room in Dayton).

Standard sized punches and buttons were used. But since forming and piercing operations were involved, hardening of the sections was necessary followed by JIG GRINDING. Result: Close tolerances held easily and perfect progression throughout — another satisfied customer.

*Vulcanaire equipment pays for itself on the first job.

Borrow Vulcan's instructive movie on jig grinding

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Engineering, Processing, Designing . . . Special Tools . . . Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and Size . . . Vulcanaire Grinding Heads . . . Motorized Rotary Tables . . . Plastic Tooling . . . Vulcanaire Jig Grinders.

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Dress Profiles like these in a few minutes without Templates or Crusher Rolls with the Jeon Automatic Angle Tangent to Radius Dresser. It's fully universal.

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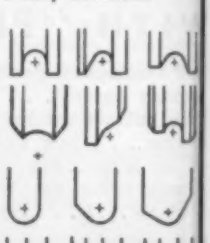

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A PRECISION WHEEL DRESSER that sets new high standards of performance

With many added features including

More cutter discs
Longer cutter teeth
A larger outer diameter
The results are in better grinding with fewer dressings

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EASY OPERATION: CLOSE TOLERANCES: ACCURACY: FINE MICROINCH SURFACE FINISH

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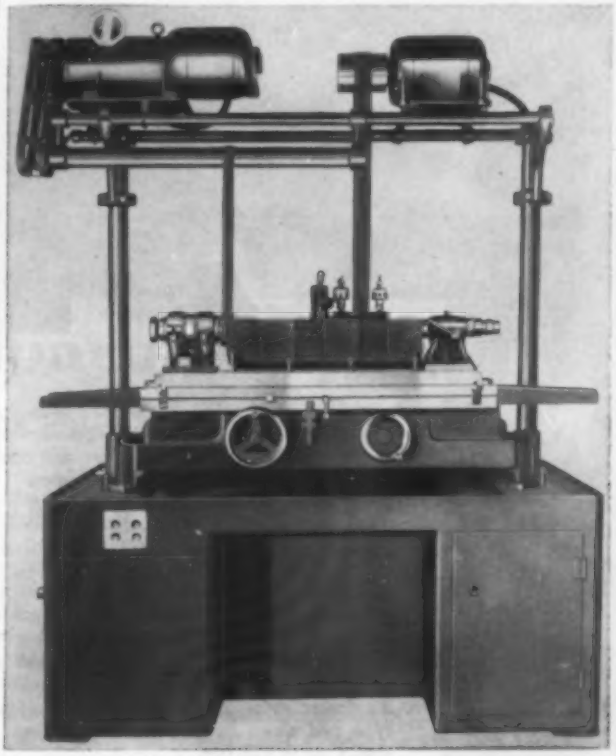
For example, fuel injectors, after having been rough ground, can be ground to .000010" roundness with a sixty grit wheel and one pass of the wheel.



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Since 1910

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NORTH AMERICAN AVIATION, INC.

Precision is paramount in the manufacture of components for aircraft power and control. That's why these makers of precision parts have Grand Rapids Grinders in their toolrooms — for the utmost in precision grinding.

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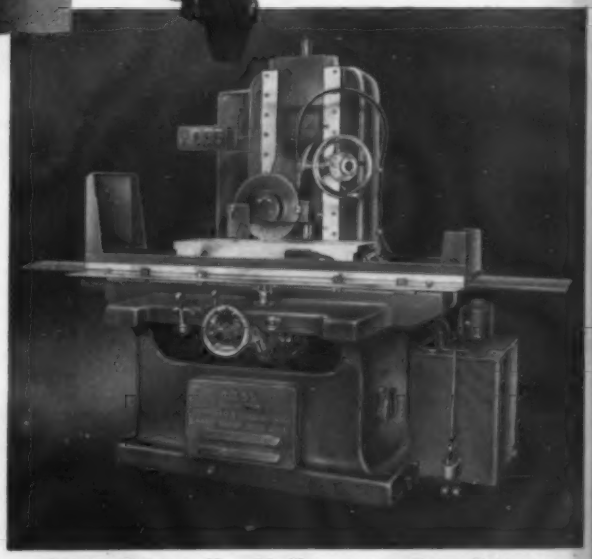
With these built-in precision features typical of all Grand Rapids Grinders, it's no wonder they're found in leading toolrooms.



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Resinoid and Vitrified Grinding Wheels

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GRINDING PENINSULAR SINCE 1895 WHEELS

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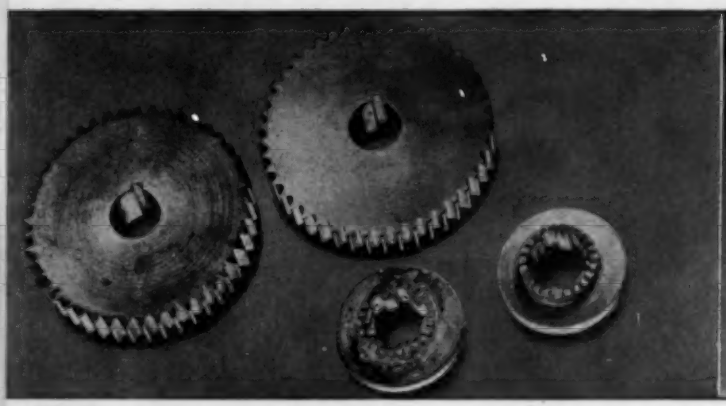

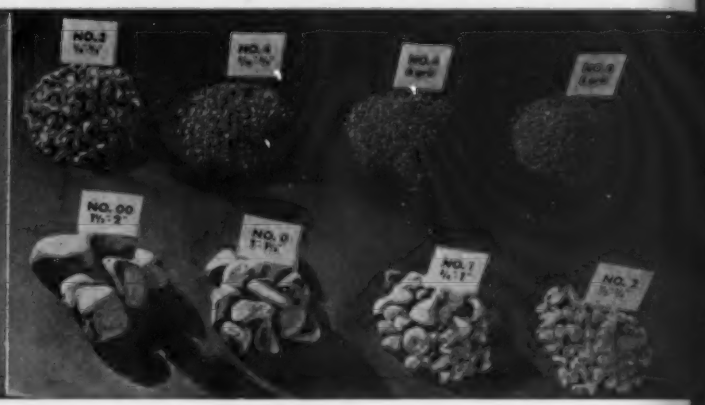

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